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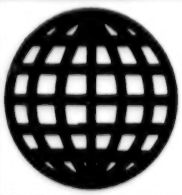

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New Principle of Detecting Moving Objects

957A0085A Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 11 Nov 94 pp 41-44

[Article by A. N. Anuashvili, doctor of technical sciences; UDC 681.8.02:532.21.3.001.6]

[FBIS Translated Text] *The paper gives the essentials of a new principle of detecting a moving object based on the scientific discovery of a law governing the manifestation of mobility of an object that establishes a previously unknown relation between such properties of the material world as motion and radiation. The concept of the "non-ranging method of detecting mobility of an object" in introduced that is based on perception of information about a moving object by coherent recording of radiation of the background against which the sought object is moving. The author discusses the results of experiments, and the significance of the proposed method for different areas of science and engineering.*

Development of Scientific-Procedural Principle of Proposed Method of Detecting Moving Objects

The Institute of Control Problems, USSR Academy of Sciences (now ICP, Russian Academy of Sciences), beginning in 1972 under the supervision of I. V. Prangishvili, has been doing research on detection of barely noticeable "invisible" objects. This research is based on the idea that *information about the object to be studied is contained in the medium surrounding* this object (in particular, in the background); it has a three-dimensional distributed (holographic) structure, and is manifested by coherent perception of the radiation of this medium.

Initially, this research was done for detecting and studying microscopic biological objects, microparticles and the like that are difficult to study under the microscope because of insufficient resolution, transparency of microscopic objects, and for other reasons.

In 1976, it was theoretically proven that if an object is moving, its information properties in background radiation show up more strongly. In particular, it was established that there is a completely defined relation, i.e. a law of conformance, between the amount of displacement of the sought object and such an information attribute as intensity of the complex amplitude of coherent background radiation averaged over the time of observation. It was specifically established that the aforementioned intensity when a moving object shows up in the probing beam decreases in proportion to its size and in inverse proportion to its velocity. This information attribute does not depend on the scattering power of the sought object; it is influenced to a significant degree by the scattering power of the background and the change of time of probing of the background by coherent radiation in case a moving object enters the beam.

In 1993, this law was confirmed in the optical wave band by using coherent laser radiation as the probing beam.

In 1986, P. P. Parkhomenko, associate member of the USSR Academy of Sciences, came up with the idea of the possibility of realizing this law in the radio wave band and using it to detect "invisible" air objects. This idea was supported in 1987 by Academician V. S. Avduyevskiy, and in 1988 by Academician Yu. N. Denisyuk. In 1990, at the initiative of Doctor of Technical Sciences S. Sapegin, work was started on implementing the new method of detecting a moving object in the radio wave band.

In 1992, the law of manifestation of mobility of an object was granted recognition as a scientific discovery by a decree of the Russian Academy of Sciences dated 22 February (authors Academician I. V. Prangishvili, Doctor of Technical Sciences A. N. Anuashvili and Candidate of Technical Sciences V. V. Maklakov).

In 1994, sufficient experimental confirmation was obtained for the possibility of implementing the new method of detecting a moving object in the radio wave band. The proposed method has also been experimentally confirmed with the use of acoustic waves as exemplified by solving the problem of detecting a weakly scattering object moving in water [1, 2].

Altered Meaning of Terms "Signal" and "Interference" in Problems of Detecting Object Moving Against Background of Other Stationary Objects (Surfaces)

It should be noted that transference of the notion that information about a sought object is contained in the medium surrounding this object, and the law of manifestation of mobility of the object, into regions of ranging methods of detection has predetermined origination of the concept of "non-ranging detection of a moving object" that does not depend on the scattering power of the object, as well as alteration of basic concepts in ranging methods of detection, "signal" and "interference," under conditions of detection of an object moving against a background of radiation of other stationary objects such as local items, underlying surface, ionosphere, sea bottom, and the like. To be specific: formerly the concept of "signal" was necessarily associated with the scattering power of the object; now backscattering of the background located behind the object is treated as the information signal.

The concept of (passive) "interference," which had been understood as backscattered radiation of the background located behind the object, does not have meaning in the new information attribute, as this concept is now related to the information signal of detection. The conventional signal—radiation scattered by a moving object—is not reflected in the new information attribute of mobility ("averaged intensity"), as it is averaged practically to zero since it leads to a random change of complex amplitude. Therefore, to facilitate understanding of its essence, the proposed new method of detecting a moving object should be called non-ranging, which emphasizes primarily that the new information attribute of detection is independent of the scattering power of the sought

object. After all, the concept of "ranging" is itself associated with radiation reflected from the object being ranged.

Using Stationary (Near-Stationary) Local Reflectors in Ranging Methods of Detecting Moving Targets, and Alteration of Concepts of "Interfering Background" and "Background-Target Environment"

The concept of "interfering background" is conventionally defined as the background surface located behind the object, since the radiation reflected and backscattered by this surface goes to the receiver and interferes with detection of the object. To suppress interfering radiation, Doppler frequency filtration is used on low frequencies, since the stationary or near-stationary background produces shift frequencies near zero.

It should be noted that specialists who work professionally in the field of radar use stationary (near-stationary) local reflectors and scattering surfaces such as the underlying surface or ionosphere (in over-the-horizon ranging) when detecting moving objects. These reflectors are treated as mirrors (or scatterers) that can be used for re-reflection, and the background located behind the object, as before, is taken as interfering. These reflectors (scatterers) are used in over-the-horizon and transillumination ranging for illuminating the object via a re-reflector, and for re-reflection toward the receiver of radiation scattered by the object.

In these kinds of ranging, the signal, as before, is taken as the radiation reaching the receiver as a result of scattering by the object (or further rescattered by the background), while interference is radiation that is scattered by the background and enters the receiver without being rescattered by the object.

Thus, the use of stationary and near-stationary local reflectors and surfaces in ranging methods of detection of moving targets does not change the meaning of the conventional concepts of "interfering background" and "background-target environment."

In the proposed "non-ranging" method of detection of a moving object, the concept of "interfering background" becomes meaningless, since the radiation scattered by the background surface located behind the object is treated as the carrier of the useful (information) signal about the sought object moving over this surface. In this context, the radiation scattered by the moving object (backward or forward) is ignored, as it is averaged practically to zero during formation of the new information attribute of mobility.

Formal Exposition of Essentials of Proposed Non-Ranging Method of Detecting Moving Objects

As has already been stated here, to facilitate understanding of its essence, the proposed new method of detecting a moving object should be called non-ranging, which primarily emphasizes that the new information attribute is independent of the scattering power of the sought object.

This new method operates under conditions of beam probing of a background such as an underlying surface, and where possible, coherent recording and accounting for backscattering of the background over which the object moves.

The new information attribute of mobility is intensity of the averaged complex amplitude of radiation backscattered by the background surface and the object (if it is a scattering object).

Based on conditions of operation of the proposed method, and the definition of the new information attribute used therewith, let us write this attribute as a mathematical formula. This formula is applicable to radiation recorded by phase detection:

$$I_{av}(t_0, T) = \left| \frac{1}{T} \int_{t_0}^{t_0+T} \left[a_b e^{i(\varphi_0 + 2\pi f_b t_{pb})} + a_{ob} e^{i(\varphi_0 + 2\pi f_{ob} t_{pob})} \right] dt \right|^2.$$

Here T is the time of averaging the complex amplitude of radiation; t_0 is the initial instant; a_b is the amplitude of radiation backscattered by the resolved segment of background; φ_0 is the initial phase of the source of radiation (oscillator); f_b is the frequency of radiation scattered by the background (given that the background and source of radiation are stationary relative to each other, this frequency coincides with that of the source of radiation); t_{pb} is the time of probing the background, i.e. the time required for radiation to make the round trip from the source of emission to the background segment being resolved and back; a_{ob} is the amplitude of radiation scattered by the object; f_{ob} is the frequency of radiation scattered by the object; t_{pob} is the time of probing the object, i.e. the time required for radiation to cover the round trip from the source of emission to the object and back.

All objects are conventionally divided into two classes: weakly scattering and strongly scattering.

An object is termed weakly scattering when it scatters radiation toward the observer so faintly that recording by the receiver is impeded, i.e. the energy reaching the receiver from the object is less than that of set noises.

An object is termed strongly scattering when it scatters radiation toward the observer so intensely that it is easily picked up by the receiver, i.e. the energy picked up by the receiver from the object is greater than that of set noises.

For the sake of convenience in our treatment, let us write the aforementioned information attribute as a functional dependence of parameters:

$$I_{av} = \Phi(a_b,\ a_{ob},\ f_b,\ f_{ob},\ t_{pb},\ t_{pob}).$$

Of these parameters, ranging methods of detection use a_{ob}, f_{ob} and t_{pob}. The other parameters (a_b, f_b and t_{pb}) are not taken into account in ranging methods, as they are deemed interfering, and are filtered out in frequency processing.

In forming the new information attribute, everything is turned around: parameters a_b, f_b and t_{pb} are used, and parameters a_{ob}, f_{ob} and t_{pob} are disregarded, as they are averaged over time T practically to zero because motion of the object rapidly and randomly changes these parameters.

This is why we call the proposed method non-ranging.

The new information attribute of mobility depends mainly on the time of background probing, i.e. the time of the round trip of the beam from the antenna to the background element being resolved and back. When a moving object shows up in the probing beam, it changes the time of background probing regardless of the scattering power of this object. The change of background probing time in turn randomly changes the complex amplitude of the received radiation, and further (as a result of time averaging) reduces the initial value of the aforementioned information attribute (when there was no object). This reduction is the signal of detection of a moving object.

In experiments done by using an observation system with low resolution (spatial element of resolution much larger than the area of the object), estimates were made of the change of the given information attribute of mobility of the object in time:

$$I = I_{av}(t_0,\ T) - I_{av}(t_0 + T,\ T).$$

The experiments confirmed stable detection of a weakly scattering object of small size moving at low velocity against a background of strong reflections from an underlying surface.

For purposes of graphic demonstration of manifestation of the given information attribute of motion, we give the results of experiments in the optical band (high resolution, large receiver aperture).

Figure *a* [graphic not included] shows the image of an observed scene with recording of averaged intensity of received radiation. The background was a scattering metal plate, and the object was a glass plate (transmitting object).

Figures *b* and *c* [graphics not included] show images of the observed scene with registration of the intensity of the complex amplitude in the field of view averaged over exposure time when the object is stationary and moving during exposure (figures *b* and *c* respectively).

As can be seen from figure *c*, the intensity of complex amplitude averaged over exposure time in the case of mobility of the object decreased in the region of location of the moving object.

It should be noted that when the resolution of the observation system is high (spatial element of resolution much smaller than area of object), the relation between intensity of averaged radiation and parameters of motion of the object has a completely explicit form:

$$I_{av} = \begin{cases} 0, & vT\sin\alpha \le d; \\ I_b\left(1 - \dfrac{d}{vT\sin\alpha}\right)^2, & vT\sin\alpha \ge d, \end{cases}$$

where I_b is the intensity of background radiation; T is time of averaging of complex amplitude of radiation; d is the projection of the dimension of the object in the plane of observation; α is the angle between the direction of motion of the object and the direction of observation; $vT\sin\alpha$ is the projection of displacement of the object in the plane of observation.

As we can see from the formula, when displacements of an object are smaller than its size, intensity in the field of view decreases to zero (as is shown in the experiment in the figure) and otherwise not to zero (with dependence inversely proportional to the amount of displacement).

Hardware implementation of the described method in the solution of many practical problems does not entail the need for creating any new component base.

The aforementioned law of manifestation of mobility of an object is of universal significance, and provides a new and effective means of solving problems in various areas: ecology, bioengineering, science of materials, medicine, and the like. Methods of detection based on this law can be used both in the microscopic and macroscopic world, and for solving problems of planetary and astronomical scale (e.g. detection of moving comets that are a hazard to life on earth).

The proposed principle of detection of a moving object can be recommended for radiations of any types and wavelengths, and for any objects regardless of their scattering power in the wave band used. The parameters of the system of observation (wavelength and time of averaging of received waves) should be selected to conform to the assumed parameters of the sought object: size and velocity [3].

REFERENCES

1. Anuashvili, A. N., "New Principle of Imaging a Moving Object" in: "Zakonomernost proyavleniya podvizhnosti obyekta i razvitiye metodov obnaruzheniya, kontrolya i izmereniya. Sbornik statey" [Law of Manifestation of Mobility of Object and Development of Methods of Detection, Monitoring and Measurement. Collection of Papers], Moscow, Institute of Control Problems, Russian Academy of Sciences, 1993.

2. Anuashvili, A. N., "New Principle of Moving Object Image Reception" in: "Coherent Measuring and Data Processing Methods and Devices," Publ. SPIE, The International Society for Optical Engineering, P.O. Box 10, Bellingham, Washington, 98227-1101, USA, 1993.

3. Anuashvili, A. N., "Development of New Principle and Engineering Approaches for Perception of Image of Moving Object," doctoral dissertation, Moscow, 1990.

Russian Federal Space Program for the Period to Year 2000: Prospects for Developing Communication and Broadcasting Satellites

957A0094A Moscow VESTNIK SVYAZI in Russian No 11 Nov 94 pp 3-4

[Article by Yu. N. Koptev, general director Russian Space Agency]

[FBIS Translated Text] The Russian Space Agency (RSA) was formed by a decree of the President of Russia dated 25 February 1992. The RSA is the central body of the federal executive authority implementing Russian state policy in the field of exploration and use of space for peaceful purposes.

In accordance with the Russian Federation Law "On Space Activity" and the "Regulations of the Russian Space Agency" the principal functions of the RSA are the development and implementation of the Russian Space Program and performance of the functions of the state client for space systems, complexes and equipment for scientific and economic purposes, including objects of the civilian-purpose surface space infrastructure.

In interaction with the RF Ministry of Defense and other ministries, departments, organizations and industrial enterprises the RSA is ensuring the development of a scientific research and test base for cosmonautics, organization of scientific-technical files of completed research to be used for improvement of rocket space technology, launches and control of artificial earth satellites for scientific, economic and dual purposes and the implementation of manned space programs.

The RSA also is engaged in broadening international cooperation in the field of exploration and use of space for peaceful purposes, licensing of space activity, organization and coordination of work on commercial space projects and assistance in their implementation.

Within the framework of the Russian Federal Space Program for the Period to the Year 2000, approved by a resolution of the Government of the Russian Federation dated 11 December 1993, No 1282, entitled "On State Support and Guaranteeing of Space Activity in the Russian Federation," the RSA is carrying out work in the following directions:

- development of space communication complexes and development of coordinate-time support space equipment;
- implementation of a program for the development of means for remote sensing of the Earth, meteorological observations and ecologic monitoring;
- manned flights and international cooperation on their basis;
- conduct of fundamental space research and studies in the space technology field;
- further improvement of facilities for the launch of AES (artificial earth satellites), development of space infrastructure facilities and the surface experimental base;
- construction of the surface automated complex for the control of AES for scientific and economic purposes;
- purchase of standard-produced AES and launch equipment;
- support of launches of space vehicles and their in-flight control.

Some of the principal directions in the practical use of space systems in the Russian economy are the transmission of different types of information and the organization of TV- and radio broadcasting using communication satellites. This is attributable to a number of factors, among them an increasing interest on the part of commercial organizations in the on-line transmission of different kinds of information, the existence of a number of intensively developing regions inaccessible for the organization of communication by other methods and increasing interest on the part of different state and commercial organizations in the routine transmission of different types of information.

However, as a result of the acquiring of economic independence by space branch enterprises and the reduction of defense orders some of them have stepped forward as initiators of development work on promising satellite communication systems which in comparison with other types of space activity is profitable and makes it possible to ensure returns from their operation.

Among the presently existing approximately thirty projects for satellite communication systems with AES in geostationary, highly elliptical and low circular orbits in the Russian Federal Space Program to the Year 2000 the following 19 projects are included:

- "Gals-R," "Arkos," "Mayak," "Ekspress-M," "Yamal," "Gonets" and "Signal" are being financed on a shared basis by the RSA and commercial organizations;
- "Ekspress," "Gals," "Gelikon," "Zerkalo," "Bankir," "Kuryer," "Nord," "Kondor," "Sokol," "Koskon," "SPS-Sputnik" and "Globsat" are being financed by commercial organizations.

Some of these projects are a continuation of the planned development of national systems within the framework of state programs, whereas others are being set up on the initiative of space branch enterprises and different commercial organizations which are in different stages of development work—from engineering notes to preliminary designs and the preparation of mock-up and standard copies of communication satellites.

The Russian Federal Space Program was drawn up taking into account the "Programs for the Development of a Satellite Communication and Broadcasting System for 1992-2000" ("Rossiya" Programs), approved by the Government of the Russian Federation. It is based on AES developed by the NPO prikladnoy mekhaniki

(Krasnoyarsk-26) and provides for the replacement of the "Gorizont" AES, developed in the 1970's and outdated in its parameters, by the "Ekspress" and "Ekspress-M" AES more modern with respect to fixed communication and TV broadcasting, "Arkos" and "Mayak" with respect to mobile communication, as well as organization of a national system for multiprogram direct television broadcasting in the territory of Russia and the CIS countries on the basis of the "Gals-R" AES.

It is characteristic of these AES that they are constructed on the basis of a standardized satellite platform ensuring the holding of the AES in orbit with an accuracy to 0.1-0.2 degrees, with a useful lifetime of 5 years (increasable to 7-10 years) and a high available energy for the payload.

The use of the new-generation AES "Ekspress," "Ekspress-M," "Arkos" and "Mayak" will ensure the further development of national, zonal and local networks, business communication networks and an increase by a factor of 4 or more in the handling capacity of the national system for fixed and mobile satellite communication and will substantially broaden the scope and quality of the afforded communication services.

The funding of the work under the "Rossiya" Program is to be provided mostly by commercial organizations with a relatively small—at the 13% level—participation of state funding.

During 1994, within the framework of the Russian Federal Space Program, the RSA has concluded state contracts for development of the "Ekspress- M," "Arkos," "Mayak" and "Gals-R" AES, as well as the "Yamal," a fixed satellite communication system (developed by the NPO Energiya imeni S. P. Korolev) and the "Gonets" and "Signal" low-orbit satellite communication systems (NPO prikladnoy mekhaniki and RKK Energiya imeni S. P. Korolev respectively).

These contracts provide for the preparation of design documents and the preparation of mock-up and standard-produced copies of these AES. Launches of the "Gonets" and "Signal' AES are planned for 1995.

The times for completion of work under these contracts is 1996-1997 under the condition of sufficient funding by both the state and, for the most part, commercial organizations.

Among the purely commercial projects, in our opinion, the most promising are the projects for fixed satellite communication and transmission of "Bankir" data using the "Kupon" and "Zerkalo" AES (developed by the NPO imeni S. A. Lavochkin).

The considerable degree of readiness of the "Kupon" AES must be noted; its launch is planned for 1995.

During the current year the AO Informkosmos, which includes the leading development enterprises and operators of space systems—AO NPO prikladnoy mekhaniki, Radio Scientific Research Institute of the RF Ministry of Communications, Russian Scientific Research Institute of Space Instrument Making of the Russian Space Agency and GP Kosmicheskaya svyaz of the Russian Ministry of Communications—has completed work on developing the "Express" and "Gals" AES.

The first "Gals" AES was launched on 20 January 1994; it is now parked at 71°E and is undergoing flight tests under the confirmed program with simultaneous experimental operation.

The first "Ekspress" AES was launched on 13 October 1994. After conducting tests it will replace the "Gorizont" AES and will be parked at 14°W.

In order to maintain the orbital grouping of the Russian satellite communication system the RSA has concluded contracts for the construction and 1994-1995 delivery of two "Ekspress" AES, four "Gorizont" AES and one "Ekran-M" AES, whose launches are planned for 1995-1996.

The RSA, jointly with the Ministries of Finance and Economics, other Russian ministries and departments, is now formulating work plans and allocating the amounts of funding from the budget for the space branch for 1995.

The implementation of the Russian Federal Space Program, supported by timely and adequate funding, will enable our country, laying the way into space, to create conditions for carrying out socioeconomic programs for the purpose of the renewal and flourishing of Russia.

Systems for Personal Mobile Communication Via Low-Orbit Artificial Earth Satellites

957A0094B Moscow VESTNIK SVYAZI in Russian No 11 Nov 94 pp 6-10

[Article by L. Ya. Kantor, section head, and I. S. Povolotskiy, laboratory head, Radio Scientific Research Institute]

[FBIS Translated Text] During recent years there has been extensive discussion of projects for organizing satellite personal communication systems based on low-orbit satellites: "Iridium," developed by the American Motorola Company, "Globalstar," developed by a consortium of companies—Loran, Qualcom, DASA and others, as well as the Russian "Signal" and "Gonets" projects, and others.

Interest in these projects is attributable primarily to their possibilities for ensuring personal telephonic communication using compact terminals of the handset type such as are used in surface cellular systems. Their principal advantage over geostationary systems, however, is an energy gain by a factor of a thousand due to lesser signal propagation losses.

This also makes possible, via relatively simple and inexpensive satellites, communication with a subscriber

on the Earth having a terminal with a nondirectional antenna and a low-power transmitter. That is why communication systems with low-orbit satellites may be definite competition for surface cellular systems and at the same time supplement them well, particularly in remote poorly populated regions.

"Iridium"

This communication system with satellites in low orbits is the most widely known in the world as a plan for a mobile satellite communication system with the possibility for personal communication by a subscriber using a compact handset similar to that used in surface cellular radio communication networks already introduced in Russia.

Communication networks of the "Iridium" system will be linked up with existing general-use telephone networks, including surface cellular mobile communication networks, through base stations performing all the necessary interface functions.

The technical possibilities of the system make it possible to afford communication services within the boundaries of each country, but this requires permission from the Communications Administration.

In addition to transportable telephone communication devices it is proposed that use be made of collective communication devices (automatic telephones) installed in places not equipped with stationary communication facilities. Terminals of the "Iridium" system also can be used on passenger airlines for affording in-flight communication services for passengers. The transmission rate for verbal communications is 4800 bits/s.

In addition to telephonic communication the "Iridium" is capable of ensuring transmission of data and faxes between any points on the planet. For this purpose it is sufficient that system subscribers outfit the oral terminal with a modem. The data transmission rate is 2400 bits/s.

In addition, the system ensures transmission of communications on the coordinates of the subscriber, determined by both oral communication devices and special subscriber radio determination devices.

Communication with a mobile subscriber is accomplished in the range of the mobile satellite service (MSS) and with a station for interfacing with the general-use switching network—in the fixed satellite service (FSS) range.

Communication in the directions surface-space and space-surface is ensured in the L-range in the band 1616-1626.5 MHz, but whereas the surface-space line will operate on a primary basis, the space-surface line will operate on a secondary basis.

Feeder lines, ensuring communication between a satellite and interface stations in the network, as well as control stations, will operate in the Ka-range of the FSS in the frequency bands 19.4-19.6 GHz on the space-surface line and 29.1-29.3 GHz on the surface-space line.

For the routing of calls provision is made for intersatellite communication, which also will be accomplished in the Ka-range in the band 23.18-23.38 GHz, specially allocated for intersatellite communications.

The "Iridium" space complex consists of 66 satellites positioned in circular polar orbits with an inclination 86° and an altitude 780 km. The satellites are positioned in 6 orbital planes, in each of which there are simultaneously 11 satellites. The angular distance between adjacent orbital planes is 31.6°, except for planes 1 and 6, the angular spacing between which is about 22°.

The antenna system of each satellite forms 48 narrow rays in the L- range. The interaction of all the satellites ensures global coverage of the Earth using approximately 2100 active rays of their total number 3168. (Not all rays are active because adjacent satellites may form greatly overlapping zones which must be serviced by only one satellite.)

Multiple frequency use is employed in the system. The necessary decoupling is ensured by the spatial separation of the rays. Repeated frequency use is allowed in each seventh ray.

The handling capacity of each satellite in the L-range is 3840 channels. The existing possibilities for the redistribution of capacity among rays for one satellite make it possible to transmit between 4 and 960 channels in one active ray.

Signals in the L-range are transmitted by the four-position FM method using the multistation access technique with combined time and frequency separation.

Frequency access is realized by dividing the entire allocated frequency band with a width 10.5 MHz into 250 frequency bands, each with a width 41.67 KHz, in which an individual carrier can be transmitted at a rate 50 kbits/s.

Time access is realized by time multiplexing of each carrier with four channels at a rate 4.8 kbits/s (the total rate of data transmission for each carrier is 50 kbits/s). Signals of both the "upward" line and the "downward" line are transmitted in one time frame. The duration of the time separation access method frame is 90 ms; the duration of the subframe for the transmission of one channel is 8.28 ms.

The required ratio of signal strength to spectral noise density in a subscriber channel of the L-range is 6.1 db. The error probability in the worse case with an unfavorable positioning of the subscriber relative to the servicing satellite is 10^{-2}; the mean error probability is $10^{-4}...10^{-5}$.

Signals are transmitted in the Ka-range on the line between the satellite and the interface station, as in the

L-range, by the four- position FM method using the multistation access technique with combined time and frequency separation.

Frequency access is realized by dividing the entire allocated frequency band with a width 200 MHz into 12 frequency bands, each with a width 15 MHz, each with an individual carrier and a data transmission rate 6.25 Mbits/s. Transmission is accomplished with coding at a rate 1/2, that is, the rate of data transmission is 3.125 Mbits/s. Each satellite can simultaneously transmit two carriers with a total handling capacity of about 3000 channels.

The required ratio of signal strength to spectral noise density in a feeder line in the Ka-range is 7.9 db; the probability of error is 10^{-7}.

The intersatellite communication lines of each satellite are organized with four adjacent satellites, two of which are situated in the same orbital plane, whereas the other two are in adjacent orbital planes.

Signals in the Ka-range on intersatellite lines are transmitted by the four-position FM method at a rate 25 Mbits/s.

The entire allocated band with a width of 200 MHz is divided into 8 frequency bands, each with a width 25 MHz. A separate carrier can be transmitted in each of these frequency bands. Transmission is with coding at a rate 1/2, that is, the data transmission rate is 12.5 Mbits/s. The satellite can transmit four carriers simultaneously, one for each of the adjacent satellites, with a total handling capacity of about 6000 channels.

The required ratio of signal strength to spectral noise density in an intersatellite line in the Ka-range is 7.9 db; the probability of error is 10^{-7}.

The principal specifications of the "Iridium" system, distinguishing it from other systems, are as follows.

The "Iridium" establishes the overwhelming number of connections using intersatellite communication lines, provided that the subscribers are not in a zone serviced by one ray. Accordingly, for connection with surface communication facilities it is planned that there be a total of 10-20 interface stations. Each station can service many countries or even an entire continent. Plans call for setting up one or two interface stations in Russia. Such a system structure may result in a unjustified increase in the length of the surface communication lines used and a corresponding increase in the cost of a connection.

On the "Iridium" satellite there is complex processing of signals involving the separation of the arriving multiplexed signals into individual digital series and their subsequent combining in accordance with the required addressing in a high-speed digital flow for transmission along an intersatellite line or along a communication line with an interface station.

A subscriber of the "Iridium" system has an individual number which he keeps regardless of where he is located. Information on the location of the subscriber is always stored in the memory of the surface station to which the subscriber is assigned. For revising information on his location the subscriber need only use his terminal. In organizing communication the system also automatically registers the coordinates of the subscriber.

"Globalstar"

The "Globalstar," like the "Iridium," provides mobile satellite communication services—AF, PD, fax, supplementing surface cellular networks, and also affords services in poorly populated regions throughout the world.

The system consists of 48 small satellites. The total cost of the development work, production and launch of satellites, as well as operating costs up to 1997, is estimated at 2 billion dollars.

The distinguishing feature of the system is the technology for multistation access with code separation of signals. The planned technical-economic specifications are attained by code separation and control of transmitter power, allowance for the verbal activity of the subscribers, a multiray antenna ensuring repeated use of frequencies and a high satellite antenna amplification factor.

Two stages of system development are envisioned: in the first stage 24 satellites are to be launched for organizing communications over the territory of the United States and in the second—48 satellites for ensuring global communication.

The surface segment consists of a great many interface stations ensuring connection with surface telephonic and mobile communication networks in the zone of each satellite.

In the planning stage provision was made for two variants of system construction: A and B. The ranges used in these systems are represented below.

Communication line	System A	System B
satellite-subscriber	L	S
subscriber-satellite	L	L
satellite-interface SS	C	C
interface SS-satellite	C	C

Principles for constructing system A: range 1610.0-1626.5 MHz for subscriber-satellite communication lines (on both the "upward" and "downward" lines); for communication with interface stations use is made of communication channels in the FSS range 5199.5-5216 MHz ("downward" line) and 6525-6541.5 MHz ("upward" line).

Multistation access-code separation method. The L-range is divided into 13 subranges with a width 1.25 MHz each. The L-range spectrum is repeatedly used

twice on the "upward" and "downward" lines and three times by the switching of rays. Taking into account that 48 satellites are used in the system, the repeated use of the spectrum attains 288 times (48 x 6). The C-range spectrum (feeder lines) is repeatedly used twice by means of use of double polarization: right- and left-handed. Each mobile subscriber uses the very same L-range frequency for both reception and transmission.

As an alternative to system A system B is being considered for ensuring communication within the United States: L-range (1610-1626.5 MHz) for the "upward" subscriber-satellite line and S-range (2483.5-2500 MHz) for the "downward" line. For combining the signals of the six rays they are summed in the feeder line. In the initial system deployment stage it is proposed that range C (6484-6541 MHz "upward" and 5158.5-5216 MHz "downward") be used in communication feeder lines; this will be used twice due to use of right- and left-hand polarizations. In contrast to system A, time separation and switching of rays is not used. Variant B is now the principal system variant.

One of the principal requirements which is guiding the developers of the "Globalstar" system is its compatibility with existing telecommunication facilities. Whereas the "Iridium" project is oriented on use of intersatellite communication lines, in the "Globalstar" system the principal communication elements are interface stations on which are imposed the functions of ensuring an interface with existing telecommunication systems, in particular with telephone networks. Accordingly, the surface interface stations must have a low cost; indeed, it is precisely they which determine the cost of servicing of the subscribers not covered by mobile communication systems.

The "Globalstar" system does not use intersatellite communication lines. This makes it possible to use satellites which are simpler and cheaper than in the "Iridium" system. Surface communication lines, interfacing with which is ensured by numerous base stations located alongside switching centers, participate in organization of any connection.

The use of complex noiselike signals makes it possible to solve the problem of smoothly switching a subscriber from a setting satellite to a rising satellite. A signal from a subscriber is received and transmitted simultaneously from two satellites and the surface stations process the total signal, which makes the process of switching of satellites inconspicuous.

"Signal"

The "Signal" satellite communication system for communication purposes uses several ranges: 0.2/0.4; 1.5/1.6 and 11/14 GHz. There is frequency- code separation of communication channels in combination with spatial-polarization separation. The system uses a 6-ray antenna for communication with subscriber stations in the ranges 0.2/0.4 and 1.5/1.6 GHz, but 3 rays for communication with interface stations in the range 11/14 GHz. It is planned that subscriber stations be outfitted with pencil-beam antennas operating in an autotracking mode. The range 0.2/0.4 GHz is used for the most part for unidirectional transmission of information to subscribers. Accordingly, the rate of information transmission in this range also is 0.66 kbits/s, whereas in transmission of speech and data in other ranges the rate in the channel is 4.6 kbits/s.

Base stations are used in organizing communication between subscribers, that is, all connections between mobile subscribers occur only via base stations in two hops. In the system it is planned that there will be five base stations in Russian territory.

The following channels are organized on each space vehicle:

- information channels; channel for signaling system No 7 (for transmission of interrogations);
- technical control channel;
- "Mayak" unidirectional "downward" channel (marker, identification signal of particular satellite);
- unidirectional "upward" channel between base station and satellite ("activate satellite" channel) for switching on instruments upon entry into the zone of radiovisibility of an arbitrary base station.

The system uses a four-position FM system, supplemented by individual modulation of a pseudonoise series (PNS) with a duration of 3244 bits for each satellite. In each ray up to 10 duplex communication channels, spaced 25 kHz in frequency, are organized. Access protocols used: in the service channel—unpulsed ALOHA, in the information channel—MCA- MC/DC (multichannel access with monitoring of the carrier and with detection of conflicts).

Onboard processing involves removal of PNS modulation in each channel and transfer of signals to the frequencies of the "satellite-base station" communication channels; aboard the satellite a strict switching scheme is used--each channel on the "upward" line strictly corresponds to one of the channels in each ray on the "downward" line. There are three rays on the "downward" line so that up to three base stations can operate with one satellite.

Comparative Analysis of Low-Orbit Systems

The principal projects for systems with low-orbit satellites which have now been carried out are the "Iridium" and "Globalstar" projects. Among the owners of these systems there is an acute competitive struggle for attracting users.

The principal company engaged in constructing the "Iridium" is Motorola (United States); the Scientific Atlanta company (United States) and others are also participants.

Investments in the "Iridium" system are being made (in an amount of about 40-50 million dollars) by the Khrunichev Center (Russia); in addition, this center has signed a contract for two launches of "Iridium" satellites using a Proton booster.

The principal companies engaged in construction of "Globalstar" are Loral (space segment) and Qualcom (coding and modulation system) (United States).

Both systems use low-flying satellites in circular obits. Other data are given in the table.

Project	"Iridium"	"Globalstar"
Number of satellites	66	48
Orbital altitude, km	900	1400
System capacity, thousands of channels	56	65
Useful life, years	5	7.5
System cost, billions of dollars	3.4	1.7
Cost of subscriber terminal, dollars	3000	750
Proposed per-minute cost (satellite segment only), dollars	3	0.3

We see that "Globalstar" is promising more advantageous conditions for the subscriber, which in part is attributable to the simpler and lighter satellites of this system.

The "Iridium" was devised as a system capable of ensuring connection between any of its subscribers without participation of surface communication lines. This provides it some independence from the surface network, but requires construction of communication lines between satellites, due to which the satellites become heavier, more complex and more costly.

Each "Iridium" satellite must contain a commutator, as well as equipment for several (4-6) lines for intersatellite communication with satellites in adjacent orbits and with adjacent satellites moving in the same orbit.

Since all satellites move, for intersatellite communication lines it is necessary to use tracking antennas.

A connection is formed as follows: personal subscriber - closest satellite—series of satellites, until the signal reaches the necessary region—the called personal subscriber.

In those cases (and they will be the most frequent of all) when the "Iridium" subscriber wants to be connected with a subscriber in the ordinary surface telephone network, which, as usual, is located in the same or in a neighboring city, the "Iridium" system, having an extremely small number of surface interface stations, is inconvenient. The call will pass through a number of satellites to a base station (1-2 for all of Russia, 1 for all of Europe) and then via the surface network is returned to the surface network subscriber. This involves additional expenditures. In the "Globalstar" system a base station is provided for in each zone, there are no intersatellite lines and the connection with a nearby subscriber of the public network occurs along the shortest path, but in this case any connection requires use of surface lines.

As can be seen from the data cited above, on the lines between interface stations and the satellite (feeder line) use is made of the frequency bands allocated under the Regulations for Radio Communication Via the Fixed Satellite Service. Such is the recommendation of the Regulations.

However, these same frequencies are used by communication satellites in a geostationary orbit, which is now solidly occupied in the entire allowed frequency band. An analysis indicated that inadmissible interference arises between communication systems using geostationary and low-flying satellites. The regulations prescribe that in this case nongeostationary satellites be excluded, which is unacceptable from the operational point of view.

This matter is now being studied by the International Telecommunications Union, seeking ways to reduce interference or to allocate a special band for feeder lines for mobile communication service systems. It is probable that systems with low-flying satellites must change the used frequencies on the communication line with an interface station, which will result in an increase in expenditures and will delay the time of their realization.

Neither the "Iridium" nor the "Globalstar" today will be able to compete with the surface cellular system (earlier "Iridium" had such plans), but will supplement it, for which a dual-purpose subscriber's terminal (handset) has been developed which is capable of operating both via a satellite and in a surface cellular network. The greatest demand for satellite systems may be in regions with poor development of the surface cellular system (Russia, South America, Africa, part of Asia).

The methods for transmitting signals (modulation, multistation access) are different: "Iridium"—frequency-time separation, "Globalstar"—code separation.

Each of the methods has its pros and cons, but both are quite complex and are realized on the basis of special microcircuits with a high degree of integration.

Both systems claim global coverage, which naturally follows from the use of moving satellites moving over the entire Earth.

In both systems telephonic communications are transmitted in discrete form at a low rate of 2.4-4.8 kbits/s, which although it does not correspond to the standards

of a general-use telephone network with ordinary (stationary) telephones, evidently will be allowed for these systems, as has already been done for surface cellular systems.

Plans call for introduction of the "Globalstar" system to be begun in 1997; for the "Iridium" system experimental satellites already are being constructed, although the time for the beginning of operation is not stipulated in recent documents.

In evaluating the possibilities of realizing the systems it must be taken into account that the Motorola company is the world's leading company for the development and mass production of integrated microcircuits; it also is the most important producer of personal handsets for surface cellular radio systems. And it can be assumed that such a company will be able to cope with the highly complex technical and investment problems involved in developing the "Iridium" system.

The company already has been allocated a special frequency band (1.610- 1.6165 GHz) for a mobile satellite service (for subscriber lines), carrying out an enormous amount of work at the World Radio Conference in 1992. However, it is evidently still necessary to introduce some changes into the "Iridium" system (for example, the situation has already changed with respect to surface cellular networks—cooperation instead of competition).

The Loral (rocket-space, including for military purposes) and Qualcom (methods for processing of signals in digital form, surface cellular networks) companies also are well-known major enterprises and are capable of making the "Globalstar" system a reality.

As already indicated, in Russia there has been an announcement of organization of several systems of low-flying satellites. This presupposes the availability of different launch vehicles, including military-purpose rockets, removed from military use. The development of two of them—"Gonets" and "Signal"—is most probable.

The Russian system based on low-flying "Gonets" satellites for the time being is being realized only in an E-mail variant, that is, transmission of communications with some delay. It will operate in a relatively low- frequency (0.2-0.4 GHz) frequency range.

The "Gonets" system has already undergone flight tests with two satellites over the course of a year, after which the satellites ceased to exist. That this system can be realized is unquestionable because it has successfully operating prototypes.

However, the handling capacity of the system in the first stage—the E-mail stage—is extremely small and systems for the delayed transmission of communications via geostationary satellites (such as those already in operation, including in the territory of Russia, the "Eutelsat" system, operating via the "Eutelsat" satellite in the range 11/14 GHz) can compete with it.

A second stage in development of the "Gonets" system with the possibility of telephonic personal communication is planned, but this will require large expenditures on building new satellites and surface terminals, and insofar as we know, it has been postponed for an indefinite period.

The Russian "Signal" system is close in its parameters to the "Globalstar" system, although it has a lesser capacity. In the event that the ITU makes other decisions with respect to the frequency band for feeder lines (and it is already evident that they will be different), it will be necessary to introduce changes into the "Signal" system, as into the foreign systems described above.

The launch of the "Signal" experimental satellites is planned for late 1994; the realistic time for operational deployment is unknown, as are the sources of funding.

The two Russian systems will scarcely be serious competitors for the "Iridium" and "Globalstar" systems. Several other similar systems with low-flying satellites, whose development has been announced in Russia, will evidently have difficulties in their implementation due to the absence of funding.

In Russia still another mobile satellite communication system, the "Marafon" system, is being developed. It is included in the national program for the development of satellite communication in Russia and is being funded by the AO Informkosmos. "Arkos" geostationary satellites and "Mayak" satellites in highly elliptical orbits will be developed (under the plans, in 1995). However, the "Marafon" is not a personal communication system like a cellular system, but uses larger surface stations with antennas not less than 0.5-0.4 m in diameter installed on moving objects—ships, aircraft, as well as in a stationary mode. The surface stations correspond to the standards of the international "Inmarsat" system.

In conclusion it must be noted that the "Iridium" and "Globalstar" systems cannot be developed in Russian territory until they have received permission of the State Committee on Radio Frequencies for the use of frequencies for base and personal stations, have licenses from the Russian Communications Administration for affording services and the equipment is certified. For the time being no decision has been made on use of the L-range by personal mobile communication systems by the competent Russian frequencies agencies. Until recently the sole applicant for use of these frequency bands was the "ElekonStir" system, intended for the purpose of tracking the movement of freight and ensuring its safety. It is very difficult to solve this problem, especially since only one system can operate in the allocated frequency band. For joint use of several systems it will be necessary to divide the allocated frequency band into individual small sectors, which would considerably reduce the handling capacity of each system.

Since the process of planning all these systems has still not been completed, their parameters can be changed without substantial expenditures.

We feel that satellite mobile personal communication systems must find use in Russia, but only as a supplement to stationary general-access telephonic communication networks with stationary terminals and as a supplement to surface cellular networks.

VSAT in Russia

957A0094C Moscow VESTNIK SVYAZI in Russian No 11 Nov 94 pp 11-13

[Article by M. N. Dyachkova, team director, and V. I. Dyachkov, laboratory head, Radio Scientific Research Institute]

[FBIS Translated Text] Satellite communication stations of the VSAT (very small aperture terminal or small surface station (SSS)) type include satellite communication stations having definite specifications described in Recommendations 725-729 of the CCIR [1]. Commentaries on the VSAT specifications proposed in [1] were presented in [2].

In contrast to the stations used in the reception of satellite TV, which also may be extremely small, the receiving-transmitting SSS operate in a duplex mode and are intended for low-traffic networks (abroad primarily for separate networks) and usually are installed at the enterprises of a user. Despite the apparent restrictions on the type of stations assigned to the VSAT category, they may have parameters varying in a wide range. For example, according to CCIR recommendations it is admissible to use antennas with a diameter up to 5 m when working in wide zones; the rate of transmission of telephonic information and data may attain 2048 Mbits/s and the transmitter power may attain 100-200 W.

However, rather rigorous electromagnetic compatibility requirements are imposed on VSAT stations because there may be quite a large number of such stations in the network. For example, in the United States, where VSAT networks have been most developed, the number of these stations attains hundreds of thousands. These networks belong primarily to individual companies—banking, petroleum, retail trade and other enterprises—and are intended for communication between remote divisions of companies and the home office.

In classical VSAT networks the operation of stations is rigorously controlled by the central station in the network (the architecture of such networks is usually of the "star" type) and therefore the startup of a VSAT station for transmission occurs only after the central station is convinced of its correct operational mode; if there are any irregularities the station transmitter is shut down.

For the time being there are few networks and surface stations of the VSAT type as rigorously understood. The network of the "Vostok" bank operates on the basis of surface stations with antennas having a diameter 2.5 m. The separate network of the Central Bank ("Bankir") operates on the basis of the "Kupon' satellite, etc.

VSAT stations have been used for constructing a series of satellite communication lines which interface with international networks through the switching centers of telephone networks in Western Europe and the United States. The diameters of their antennas, depending on the traffic and the space segment used, is from 2 to 9 m.

It would be most important for Russia to use SSS for the development of rural and intrazonal communication. It must be remembered that for coverage of the extensive territory of the country it is necessary to have broad rays accordingly not having extremely great power flux densities at the Earth's surface. Accordingly, reliable reception requires quite large stations with antennas measuring approximately 4 m.

The program for development of satellite communication in Russia has provided for the extensive use of SSS [3].

Requirements for SSS. The marketing of equipment for satellite communication surface stations, including SSS, carried out by the Radio Scientific Research Institute and the NPF NIIR-Servis, indicated that there is a potential market for this equipment in Russia.

The need for satellite channels for Russia, determined by Giprosvyaz with allowance for existing conditions and the development of telecommunications networks under the conditions of the economic dropoff in the branch prevailing at the present time, the measures adopted for emerging from the investment crisis and its anticipated stabilization by late 1995, is roughly 30 thousand channels up to the year 2000.

However, this figure is based on an evaluation of the needs of the population and enterprises (state and commercial) for communication channels and poorly takes into account the real possibilities for obtaining necessary investments from state and private investors.

A more realistic figure, based on the questioning of a number of companies constructing satellite communication networks or planning their construction, is: about 10 thousand channels (with a rate of 32 kbits/s) up to the year 2000.

When determining the need for satellite channels it was assumed that in the future they must be used for organizing virtually any—rural, zonal and national—communication lines, especially in those regions of Russia where the use of surface facilities is not economically justified, difficult or entirely impossible due to geographic, climatic, geologic or other conditions.

In the territory of the country there are 23 such zones (of a total of 71) in which there are 668 rayon centers and isolated cities (68% of the total number).

It is recommended that satellite channels be used for organizing connecting lines between rural telephone exchanges, particularly in remote poorly populated regions, and also for providing telephone services for

those rural populated places which up to the present time have no telephones. Naturally, the principal type of surface stations there will those of the SSS type.

Choice of channel parameters for SSS. In accordance with the principles of the Russian Interlinked Communication Network (ILCN) the SSS AF channel afforded the user must correspond to the specifications imposed on channels for surface (cable or radio relay) communication facilities. And requirements not only on such quality parameters as signal-to-noise ratio, amplitude characteristics, etc., but also on the undistorted propagation of special signals for establishing communication, switching of channels, rate-setting principles, etc.

At this time in digital satellite communication systems abroad and in Russia extensive use is being made of the standard conversion of the AF signal into a digital form using pulse-code modulation at a rate 64 kbits/s in accordance with companding law A or m. An AF channel is thereby formed corresponding to the requirements of Recommendation G.713 of the ICCTT [4].

However, the striving for a maximum increase in the handling capacity of satellite repeater trunks, especially in SSS networks, leads to the need for using analog-to-digital conversion (ADC) methods, making it possible to take into account the statistical excess of the telephone signal and at the same time to reduce the rate of its transmission in the channel to 32 kbits/s. (Developers of surface lines also are moving in the direction of reducing the rate of transmission of telephonic signals.)

The methods for constructing ADC for obtaining a rate of 32 kbits/s are diverse and for a long time were not regulated. Recommendation G.721, describing a method for adaptive pulse-code modulation (APCMM) of ADC for obtaining a digital telephonic signal is now in effect. Although in this case the rate of transmission of secondary multiplexing signals is reduced, in the PCM channel, in accordance with Recommendation G.721, it attains 4.8 kbits/s.

The use of satellite channels with ADC of a signal at a transmission rate 32 kbits/s will make it possible to create "digital" islands upon transfer to the digital primary network on the basis of both equipment produced in our country (particularly ITsS-32) and imported equipment [5].

However, the requirements on the quality of a satellite channel cited above are imposed only with linkup of SSS to the general-use and international communication telephone networks. In the separate networks it is possible to use vocoders or semivocoders with output rates from 2.4 to 16 kbits/s.

With the transmission of digital information in SSS networks, as was stated earlier, a broad range of rates—from 9.6 kbits/s to 2048 kbits/s—is allowed.

Choice of antenna size and coordination problems. Normalization of density of off-axis EIIM[1] of satellite communication surface stations. In the development of VSAT stations one of the most important problems is that of electromagnetic compatibility with other satellite systems. As is well known, different communication networks based on geostationary satellites operate in the very same frequency range, which results in interference and additional noise. Accordingly, it is necessary to work out criteria for regulating interference between satellite networks.

One of such criteria is the maximum admissible density level of the off- axis EIIM from surface stations. Since interference from SS may be picked up by a space station receiver, the use of antennas with the best indices for the lateral lobes leads to the most efficient use of the radio frequency spectrum and a geostationary orbit.

Off-axis EIIM in the ranges 14 and 6 GHz is defined by international recommendations (CCIR Recommendation N524 [6] and separately for VSAT stations operating in the range 14 GHz—CCIR Recommendation 728 [1].

The norms for the off-axis EIIM for VSAT stations are somewhat more rigorous than for stations with large antennas because it is necessary to compensate for the lesser selectivity of small antennas both on "upward" lines, when they create interference for the satellite receiver, and on a "downward" line when they experience interference from adjacent satellite systems.

The admissible powers of surface transmitters per one channel with an occupied band 40 or 64 kHz, computed with allowance for the norms for off-axis EIIM, and the admissible levels of the side lobes of SS antennas with a diameter 2.5 and 4 m, are about 5-16 and 8-25 W respectively for a range 6/4 GHz.

Nevertheless it must be noted that the coordination of satellite systems, due to the increase in their number and reduced angular spacing between satellites, is highly complicated. The requirements on off-axis EIIM were developed in models of interaction between satellite systems with angular spacings 5-6°, but the angular spacings are now being reduced and therefore the requirements on the off-axis EIIM, especially in the range 6 GHz, will be made more rigorous.

The present-day norms for the side lobes of antennas indicated in CCIR Recommendation 465-4 for the planning of a system of SS are virtually the limiting values—those which are attainable in modern designs at a modern technological level, that is, a further decrease in the side lobes is virtually impossible.

The following solutions are possible for reducing the reciprocal interference between some specific systems:

- in order to reduce the level of the side lobes use a large-diameter antenna, but do not completely irradiate it and in this way a maximum amplification is attained, as for an antenna of a lesser diameter, but there are better side lobe characteristics;
- for a given interference situation order antennas of a

special design ensuring a decrease in the side lobes at definite angles from the principal ray;
- impose on the AF for SSS more rigorous requirements on the antenna side lobes at angles 2-5° in the range 6 GHz.

Restrictions on the power of SSS transmitters are imposed by the already stipulated and coordinated power densities of transmitters, which are reflected in the described satellite communication systems based on the "Gorizont" satellite (which are registered with the ITU), systems based on the "Ekspress" satellite (which are in the coordination stage) and which are about 8 W.

When satisfying the already cited requirements on transmitter power stipulated for internal satellite communication networks the modes do not require additional registry with ITU agencies.

Normalization of SSS parameters. Taking into account the CCIR requirements on VSAT networks and stations, as well as the SSS operating modes registered with the ITU for Russian communication networks with use of the "Gorizont" or "Ekspress" satellites, the RF Ministry of Communications approved the Standard for Typical Surface Stations for a satellite communication line based on an "Ekspress" satellite in which the requirements on SSS (with respect to the quality of surface stations, rate of data transmission, channel quality) for their operation in the ILCN were formulated.

In accordance with the Ordering Standard of the AO Informkosmos the Radio Scientific Research Institute developed several types of SSS for 1-10 telephone channels with antenna diameters from 2.5 to 4 m and a transmitter power from a few to 200 W for the S and K ranges. It is planned that the startup of the SSS will begin in 1995.

Rates for space segment. The cost of leasing the space segment to a high degree determines the economic efficiency of the SSS network. The State Space Communication Enterprise (GPKS) has adopted rates for the leasing of the space segment for digital channels from 64 to 2028 kbits/s for different users (Russian clients and foreign companies) during operation in the general-use network and in separate networks. For example, the cost of leasing a simplex channel for a month for standard surface stations with a quality (G/T) not less than 30 db/K and operation in the general-use network at a rate 64 kbits/s for Russian clients is approximately 250.0 American dollars.

With a leasing time from three to five years a discount of 10% is offered, and for a greater period—a discount of 15%.

In constructing SSS networks the user must take into account that the rate for the space segment is increased when using SSS with small antenna diameters. Thus, the rate is increased by a factor of 3 when using SSS with an antenna diameter 3.5-4.5 m (G/T = 22.0-23.9 db/K) in comparison with SSS with an antenna 6.3-8 m (G/T = 26.0-27.9 db/K) and by a factor of 10 in comparison with an antenna of 12 m (G/T = 30 db/K) for different rays.

For the transmission of digital flows the rates for making the space segment available are dependent on the band occupied by the coded signal in a linear channel with an identical rate of data transmission.

The research carried out at the Radio Scientific Research Institute and world experience gives basis for drawing the conclusion that:

- satellite systems based on VSAT systems remain irreplaceable when organizing communication in inaccessible regions or in regions with severe climatic conditions, for rapid deployment when extraordinary situations prevail,
- for organizing separate networks,
- for international communication and for communication with a subscriber remote from a telephone network and always will find their user and their niche in the communication services market.

Bibliography

1. Recommendation ITU-RS 725-729 CCIR. Vol 1993 ITU-RS Series Fixed- Satellite Service ITV Radiocommunication Assembly, Geneva, 1993.

2. Kantor, L. Ya., What is VSAT? ELEKTROSVYAZ (Telecommunications), 5, pp 5-7, 1993.

3. Tolmachev, Yu. A., Principal directions in development of satellite communications and broadcasting in Russia, VESTNIK SVYAZI (Communications Herald), 1993 and 1994 [incomplete entry in original].

4. G.713. Tekhnicheskiye kharakteristiki kanalov IKM mezhdu 2-provodnymi stykami na zvukovykh chastotakh (Technical Specifications for PCM Channels Between Two-Wire Interfaces at Audio Frequencies). Moscow, Sinyaya kniga (Blue Book), Vol Sh-4.

5. Shvartsmvan, V. O., Zubovskiy, L. I., Vasilyev, A. B. and Gorshteyn, M. Ya., Directions in development of primary network of Interlinked Communications Network in Country, ELECTROSVYAZ, pp 12-15, No 2, 1994.

6. Recommendation ITU-RS 524-4 Vol 1993 ITU-RS Series Fixed-Satellite Service ITV Radiocommunication Assembly, Geneva, 1993.

7. Recommendation ITU-RS 524-5 Vol 1993 ITU-RS Series Fixed-Satellite Service, ITV Radiocommunication Assembly, Geneva, 1993.

Footnote

1. Effective isotropically radiated power.

New Communication and Broadcasting Satellites for Economic Purposes

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[Article by I. S. Tsirlin, Radio Scientific Research Institute, deputy director; L. Ya. Kantor, E. I. Kumysh, V. B.

Tamarkin, NPO Prikladnoy mekhaniki division heads, and A. A. Kozlov, section head]

[FBIS Translated Text] The present-day stage in the development of satellite communication and satellite broadcasting systems in the Russian Federation has its special features. The most important of them are:

- adoption for implementation of an ideology for developing a new generation of communication satellites ensuring one or at the most two purposeful payload functions with a substantial increase in the handling capacity of onboard repeater complexes and the useful life of communication and TV broadcasting satellites in general;
- a sharp decrease in the amount of state funding for the maintenance of existing orbital groupings of "Gorizont" satellites (developed during 1975-1979) operating in fixed and mobile communication and satellite TV broadcasting systems and "Ekran-M" satellites (developed during 1982- 1986), operating in the satellite TV broadcasting system;
- drawing upon sources other than the budget (loans, investment and other financial resources) for developing satellite communication and TV equipment and systems and changeover to mixed funding on a shared basis with the participation of the state and commercial organizations, which will result in elimination of the existing state monopoly on the affording of satellite communication services;
- transfer on a competitive basis of a number of functions as the principal developer of equipment and systems from state enterprises to joint-stock companies with a mixed form of ownership.

The "Program for Development of the System for Satellite Communication and Broadcasting in the Russian Federation During 1992-2000" and the "Federal Space Program of Russia During the Period to the Year 2000," defining the prospects for the development of satellite communication and broadcasting services for all categories of users in Russia, including three principal subprograms for building new communication and television satellites:

- the orbital grouping of "Ekspress" satellites which provide fixed communication and television services and should replace the outdated "Gorizont" satellites in these very same orbital positions;
- the orbital grouping of the first national satellites of the "Gals" type for direct television broadcasting;
- the orbital groupings of mobile satellite communication satellites of the "Arkos" type (in a geostationary orbit) and the "Mayak" type (in a highly elliptical orbit).

The program for the development of the satellite communication and broadcasting system in Russia also additionally defines the development of the necessary equipment and facilities in the surface segment, including central, nodal, subscriber, coordinating and other stations.

The Informkosmos joint-stock company, the founders of which are the AO Scientific Production Association Prikladnoy mekhaniki, Russian Scientific Research Institute for Space Instrument Making, Radio Scientific Research Institute and the state enterprise Kosmicheskaya svyaz, is the principal organization responsible for development work on the "Ekspress," "Gals," "Arkos" and "Mayak" orbital groupings. Work on development of the "Ekspress" and "Gals" vehicles has been carried out at the AO Informkosmos since 1990 and on the "Arkos" and "Mayak" satellites since 1993.

The space segment of the mentioned subprograms is being developed on the basis of finalized and reliable launch equipment ensuring the putting of satellites with a mass up to 2600 kg into a geostationary orbit and with a mass up to 3000 kg into a highly elliptical orbit. The preparation and launch of satellites into a geostationary orbit is accomplished using the technical and launch facilities at the Baykonur cosmodrome using the Proton booster and the DM propulsion unit or into a highly elliptical orbit from the Plesetsk cosmodrome using the Rus booster and the Fregat propulsion unit.

The "Ekspress," "Gals" and "Arkos" satellites are being developed on the basis of a single standardized service systems module, which on the one hand makes it possible to reduce expenditures on development work and on the other hand, to increase satellite reliability.

The principal specifications of the "Ekspress" satellites are given below. The satellites will be positioned at the orbital points 14°W, 19°W, 40°E, 53°E, 80°E, 90°E, 96.5°E, 103°E, 145°E.

Specifications of "Ekspress" Satellite

Orbit—geostationary Mass—2500 kg Electric power of power plant—2400 W Spatial orientation accuracy—0.1° Accuracy of retention in orbit in longitude and latitude—0.2° Number of satellites in system—13 Coordinates of subsatellite points (in °): 11 W, 14 W, 37.5 W, 40 E, 53 E, 80 E, 90 E, 96.5 E, 99 E, 103 E, 140 E, 145 E, 155 E Useful life—5-7 years Dimensions in orbit—6100 x 3600 x 21 000 mm Number of repeaters in first production stage—12 Frequency range: for reception—6 and 14 GHz for transmission—4 and 11 GHz Repeater frequency band (except No 6)—36 MHz Frequency band of repeater No 6—40 MHz Width of receiving and transmitting antenna directional diagrams (DD) (in °)—17 x 17, 15 x 15, 5 x 11, 5 x 5 Antennas with DD 5 x 11 and 5 x 5 redirected within limits of Earth's visible surface EIIM (at boundary of service zone) in range: 4 GHZ—32.6/43.7 dbW, 25.9 dbW, 31.7 dbW 11 GHz—36.2 dbW Quality (G/T) in range: 6 GHz—14, -7 db/K 14 GHz—7 db/K [Note: EIIM—effective isotropically radiated power]

The first "Ekspress" vehicle was launched on 13 October 1994 and after test firings will be parked in the orbital position 14°W for standard operation. Subsequent launches of "Ekspress" satellites will be carried out

under the plan for replacement of the "Gorizont" satellites in the interests of the Russian economy and the commercial activity of the AO Interkosmos for the purpose of compensating for the expenditures made.

The principal specifications of the "Gals" satellite are given below. These satellites will be parked approximately in the orbital positions 23°E, 44°E, 74°E, 110°E, 140°E and will ensure coverage of the entire territory of Russia.

The "Gals" satellite is intended for the transmission of TV signals to individual-use receivers with antennas of a small diameter (0.6-1.0 m), as well as to collective-use stations and to professional TV receiving stations of classes III, II and I respectively).

Characteristics of "Gals" Satellite

Orbit—geostationary Mass—2500 kg Electric power of power plant—2400 W Spatial orientation accuracy—0.1° Accuracy of retention in orbit in longitude and latitude—0.2° Number of satellites in system—13 Coordinates of subsatellite points or by choice of client on basis of universal plan (in °)—23 E, 44 E Useful life—5-7 years Dimensions in orbit—21 000 x 6600 x 4100 mm Number of trunks in first production stage—3 Range of working frequencies—11804.2-12283.7 MHz EIIM (at center of service zone)—57 dbW Width of antenna DD (in degrees)—2.5 x 1.25; 1.2 x 0.9 Quality (G/T)—0 db/K Pointing of antennas to any point in service zone

The first "Gals" satellite was launched on 18 January 1994, underwent successful trial firings and its flight tests are now being carried out. Future plans for the construction and launches of the "Gals" satellite with subsequent replacement by the "Gals-R6" satellite (with a six- trunk repeater) and by the "Gals-R12" satellite (with a twelve-trunk repeater) will be determined in accordance with the program for the development of Russian TV broadcasting and the commercial activity of the AO Informkosmos.

Specifications of "Arkos" Satellite

Orbit—geostationary Coordinates of subsatellite points (in °)—13.5 W, 160.0 W, 40.0 E, 90.5 E, 145.5 E Accuracy of retention in orbit in longitude and latitude—0.1° Useful life—5-7 years Frequency range: subscriber-satellite—1.6/1.5 GHz satellite-stationary station—6/4 GHz EIIM in range 1.6/1.5 GHz: for DD 5 x 6 (in °)—41 dbW for DD 17 x 17 (in °)—35 dbW in range 6/4 GHz: for DD 5 x 11 (in °)—32 dbW handling capacity—175 equivalent telephone channels; standard—A Inmarsat

According to development plans it is proposed that the first launch of the "Arkos" satellite will take place in 1996 and the first launch of the "Mayak" satellite will be in 1997. Work has now been completed on the technical documentation and work has begun on fabrication of the material part of the "Arkos" satellite. The technical documentation for the "Mayak" spacecraft is being worked up. The specifications of the "Arkos" and "Mayak" satellites are given below. The principal purpose of these space vehicles is to ensure communication between subscribers in moving vehicles (automobiles, sea and river ships, aircraft, railroad trains) and in remote regions, also subscribers of surface networks through stationary (central and regional) stations in mobile satellite communication networks.

Specifications of "Mayak" Satellite

Orbit—highly elliptical Orbital inclination (in °)—64-84.5 Period of revolution—11.96 hours Useful life—5-7 years Frequency range: subscriber-satellite—1.6/1.5 GHz satellite-stationary station—6/4 GHz EIIM in range 1.6/1.5 GHz: for DD 5 x 6 (in °)—41 dbW for DD 17 x 17 (in °)—35 dbW in range 6/4 GHz: for DD 5 x 11 (in °)—36 dbW Handling capacity—175 equivalent telephone channels: standard—A Inmarsat Number of satellites in system—4

In conclusion it must be noted that the high level of Russian space technologies, making it possible today, under difficult economic conditions, for the AO "Informkosmos" to construct and launch the first "Gals" and "Ekspress" satellites, is unquestionably a basis for the successful implementation of a program for the development of a satellite communication and broadcasting system in our country.

Licensing of Communication Services Afforded Via Satellites

957A0094E Moscow VESTNIK SVYAZI in Russian No 11 Nov 94 pp 35-36

[Article by V. P. Dudkin, RF Ministry of Communications, deputy head, licensing division]

[FBIS Translated Text] Licensing in the communications branch was introduced on the basis of a resolution of the government of the Russian Federation dated 22 December 1990, No 596. Then several other directives, the last of which was "On Approval of Regulations on the Licensing of Activity in the Communications Field in the Russian Federation" dated 5 June 1994, were issued.

For practical purposes, however, licensing activity was initiated by the Ministry of Communications in late 1991 when the form of the documents to be submitted for the granting of licenses and the procedure for their examination were worked out, licensing commissions were set up and the form of the license (initial variant) was determined.

At that time the tasks of the licensing services in actuality essentially involved checking the correspondence between the submitted documents and the approved forms and evaluation of the possible volume of activity by the applicant. In addition, for individual types of activity, such as local telephone communication, the

finalization of licenses was delegated to representatives of local communication agencies.

In the initial stage such a practice was justified: the number of applications was small and the types of activity represented in the applications did not require serious expertise either from the point of view of the possibility of their realization or taking into account interlinking with the already operating national communications network.

The number of examined applications and licenses issued on their basis in 1991 (the first year of operation of the specially established Licensing Division) was several dozen. Later, with the development of market relations in the national economy, many entrepreneurs understood that communications is a branch which despite large initial investments will later yield an income without serious expenditures on raw material or any other initial material, other than expenditures on electric power and repair of technical equipment whose useful life is quite great—tens of years. Already in 1992-1993 many applicants appeared for activity related to the affording of communication services, as a result of which the number of applications for licenses increased sharply.

This required serious changes in licensing activity, whose principal tasks today are:

- coordination of the actions of all juridical entities and individuals affording communication services with simultaneous monitoring and accounting;
- ensuring stable functioning of communication networks in the Russian Federation, particularly during periods of exceptional situations;
- ensuring normal functioning of the communications services market and protection of the interests of the users of these services;
- ensuring adherence to the requirements of antimonopoly legislation.

In addition, licensing in communication is one of the methods for the redistribution of profits from enterprises engaged in highly profitable types of activity—such as intercity and cellular radio telephone communication and data transmission and such poorly profitable but socially significant activities as local communication (especially rural).

All these points have been reflected in the "Regulations on Licensing in the Communications Field," recently approved by the Russian government, which were prepared with allowance for both our work experience in licensing and the experience of different countries conducting such activity over the course of several decades.

In accordance with this document the future licensee must submit a packet of documents to the Ministry of Communications, to which the licensing of activity in the communications field has been delegated: an application on the prescribed form, its corporate documents and technical proposals characterizing future activity.

In the application the future licensee provides basic data on his enterprise, describes the type of activity which he proposes to undertake and gives information on the principal indices of the communication network or network for the transmission of TV or audio programs which it is proposed be established. The application must be supported by notarized copies of the corporate documents: certificate of registry of juridical entity, charter and corporate agreement. In the case of individuals this is a certificate indicating registry of the entrepreneur.

The application also is supplemented by technical proposals, that is, a full array of materials giving the principal technical and technical- economic validations of the feasibility of establishing a communications network on the basis of an analysis of the prevailing situation and a comparative evaluation of the possible solutions.

The Ministry of Communications has prepared specifications for the preparation of technical proposals for specific types of activity. The introductory section, being the same regardless of the type of activity, must provide data on the enterprise, experience and scale of past activity, possibilities of funding, availability of technical facilities, etc.

The next section is a description of the proposed communication services. For example, in the case of use of satellite communication technical facilities the information on the system for satellite TV broadcasting and the system for the distribution of TV and audio programs must include:

- name and purpose of broadcasting system; frequency ranges used on upward and downward lines; zone of distribution of programs (with referencing to administrative division) or broadcasting zone; broadcasting principles (zonal, with time delay; AES used or the trunks based on them);
- multiplexing, modulation and multistation access methods;
- serviced territory (with referencing to administrative division);
- transmitting and receiving equipment proposed for use and its principal technical specifications;
- energy parameters (space segment, transmitting surface station—TSS, receiving surface station—RSS);
- principles of organization of AES control;
- metrologic support;
- rate policy;
- conclusions of the public health and architectural services and other interested organizations on the possibility of positioning of the transmitting equipment in the indicated place;
- measures for satisfying work and fire safety rules;
- information on additional services and methods for their implementation.

Similar information is given on systems using satellite communication facilities for organizing telephonic and other types of communication. In addition, the applicant indicates:

- loading of AES of the established system and load increase by stages of development;
- modulation, multiplexing and multistation access methods;
- system energy parameters (diameters of antennas, power of transmitters of space and ground segments, noise temperature, quality);
- signaling and control systems used.

These data are taken into account for the most part during the expert evaluation. They are not directly reflected in the license.

The Ministry of Communications is now examining problems related to the issuance of licenses for the right of activity related to the use of satellite communication equipment and facilities.

Automatic Analyzers and Measuring Systems for Control of Atmospheric Pollution

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9 Sep 94 pp 1-9

[Article by G.L. Rozinov, Chief Designer AAOT [expansion not given], Khimantomatika Scientific Production Association, director, Egir AOZT (Aktsioneroye obshchestvo zakrytogo tipa)]

[FBIS Abstract]Although Western Europe, the United States, and Japan have had several decades of experience with automatic analysis of air pollution, only at the end of 1993 did the Russian Federation Ministry of Ecology develop a world-class system for monitoring air pollution and forecasting the future condition of nature and natural resources, including the biotic components, and sources of anthropogenic effects.

To achieve these goals the YeGSEM (Unified State System for Ecological Monitoring) was formed; it has the following tasks:

- the organization of observations and the measurement of indicators characterizing the state of the objectives;
- the collection and treatment of observational data;
- the organization and management of specialized data banks characterizing the condition of natural resources of the Russian Federation;
- the evaluation and forecasting of the state of natural resources and the anthropogenic impact on it;
- information on the long-range and expeditious control of nature, including extreme situations.

In order to avoid duplication of effort, a basic organization has been set up to monitor atmospheric air, surface waters, ground waters, marine waters, and soils.

Local monitoring systems fulfill the following functions:

- to produce comparable information on the state of the environment and sources of anthropogenic impact on it;
- to issue information on a real or quasi-real time scale for taking rapid action in case of accidental contamination of nature;
- to observe indicators both for the basic monitoring and for the specific systems for the region;
- to correlate information for data banks at the regional and federal level.

The local monitoring system in particular studies gaseous aerosol emissions and wastewater.

The functions of the local level of the Automated Information-Measuring System (AIIS) are as follows:

- constant control of dynamic changes in chemical conditions (major sources of atmospheric pollution, warehouses and storehouses of aggressive and poisonous substances, and residential areas);
- establishment of facts concerning elevated background and allowable concentration level of chemical contaminants;
- identification of the scale of chemical pollution by establishing (forecasting) zones of chemical contamination dangerous to man and the national economy;
- collection, treatment, storage, and transfer of information to higher levels;
- automatic control of apparatus and instruments.

The AIIS includes monitors measuring a definite number of indicators; portable laboratories for field measurements; stationary laboratories for detailed analysis; and centers for processing information.

The analytical tasks include control of losses of aggressive and poisonous substances in ordinary, accident, and post-accident situations, control of sources of atmospheric contamination, control of the atmospheric environment of industrial enterprises, and control of human habitation areas.

Chromatography, mass spectrometry, chromatomass spectrometry, and spectrophotometry are used for precision analysis. Continuous, periodic, and express analytical methods are used as needed to control the atmospheric environment. Federation standards contain more than 20 different parameters, but there are a number of them which depend on the technical level of the gas analyzer. These parameters include measuring errors, stability over time, selectivity, rapid action, standard dimensions and mass, resistance to climate and industrial factors (vibration, acoustical noise, electromagnetic fields and radiation, explosion chambers), and reliability.

The maximal "assembly" meeting the desired requirements is apparatus controlling the air in industrial workplaces and apparatus controlling leakages.

AOZT (Aktsionernoye obshchestvo zakrytogo tipa) in cooperation with other Scientific Production Association Khimavtomatika enterprises has a broad product list of indicators and automatic gas analyzers, and measuring instruments.

A strip that changes color is used for express analysis of the air. Assembly-line production of gas analyzers based on electrochemical and sorption-frequency methods will begin in 1995. The characteristics of 17 automatic gas analyzers are presented in tabular form. Some are controlled by microprocessors. A schematic diagram of one type (SKPV) is presented.

Since 1994 the volume rate of the gas at the point of sampling has been included among the measurable parameters, and this makes it possible not only to determine the concentration of harmful substances but also specific emissions.

All the analytical apparatus undergoes certification established by Russian Federation legislation.

Figures 2; tables 10; references: 15 Russian.

Development of Automated Systems of Ecological Protection of the Region from Industrial Emissions

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9 Sep 94 pp 9-15

[Article by Ye.A. Grebenyuk, candidate of technical sciences and E. L. Itskovich, doctor of technical sciences]

[FBIS Abstract] The majority of petrochemical and petroleum refining plants in Russia are sources of air, water, and soil pollution. In particular, the region of Samara in the Volga River Basin, Ufa, and Nizhnekamsk in the Kama River Basin are mentioned.

A number of tasks are involved in the control of ecology in the region:

- the selection of measurement methods and analytical instruments to be used in stationary facilities, mobile laboratories, and laser scanning;
- the determination of a number of different types of sensors, their precision parameters, and their locations;
- the development of the functional and technical structures of a monitoring system;
- the evaluation of methods and periods of collection of measurement information for different environmental conditions;
- the treatment of the measured information (filtration, neutralization, analysis of routine measurements);
- the diagnosis of nonevaporative sensors and units of the system;
- the optimal planar and three-dimensional interpolation of measurements at observational points; the plotting of timely ecological pictures of the region for any given profile.

In order to observe and forecast ecological disturbances before they acquire a catastrophic character, it is necessary:

- to observe immediately the moments of violation of allowable limitations of the content of the environment;
- to observe changes in the environment even when they do not lead to ecological disturbances;
- to determine a statistical prognosis of the qualitative state of the environment at the measuring points.

One of the most important tasks is prognosis over time and prognosis of the area of environmental pollution. The solution to this problem is ordinarily based on the design of a mathematical model describing the dynamics of the concentrations of the chemical components and is one of the variants of diffusion equations, the parameters of which are determined by meteorological conditions.

After observation of ecological disturbances of the environment, it is necessary to determine the source, the place of origin, and the times of generation of the emissions. Probabilities for these can be determined in advance from the mathematical model.

Ecology specialists are needed in the cities and rayons in order to make decisions to protect the population.

An example of the design of a mathematical model and its calculation is given.

A special system of control is necessary which is based on the state of the production process for the purpose of forecasting the future values of the parameters being controlled and keeping the yield within allowable limits.

The first step of control is to analyze the process with an adequate mathematical description. To obtain the model, average values are calculated, the possibility of violation of the restrictions is verified, and a forecast of several days is set up. If the model indicates a poor quality process, the command is given to readjust.

The second control step is to verify conformity of the process of the model with new observations. Each new observation is analyzed, and if the process has changed, an "alarm" goes off. The character of the nonconformity is determined. It may be due to a defect in the mathematical model, or it may be due a real disturbance in the process. Either the mathematical model is revised, or the process is changed before an accident occurs. Examples are given.

Automated monitoring has the following sequential steps:

- a model is designed for the production process;
- observations are processed so that deviations are signaled to the operator;
- a new model is designed to convert the process to the normal state, and the process begins again.

Prompt observation of changes in the model improves forecasting quality.

The following tasks are necessary for designing a system of ecological protection of industrial regions:

- optimal layouts and programs for forming a dynamic picture of the region;
- timely observation of ecological disturbances at any point in the region;
- forecasting of the development of ecological disturbances and their dispersion from the site;
- establishment of the places of origin of ecological disturbances;
- design of an expert system for treating the recommendations for protecting the environment.

Figures 6; tables 2; references: Russian 7 Western 15.

Computerized Analytical Systems for Ecological Monitoring

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9 Sep 94 pp 15-17

[Article by A.A. Popov, director of technical sciences, and S.V. Kachin, candidate of chemical sciences]

[FBIS Abstract] Two concepts have developed in a parallel way to evaluate the state of natural and technological objectives. The first of them—ecological control—poses the task to specialists not only of obtaining metrologically correct and juridically specificized results, but also the task of their personification. Within the framework of this concept it is necessary to design a basis for precise establishment of the volume of allowable emissions and discharges from a given enterprise, the dimensions of the pay for the management of nature and the penalties for violations. The second concept—ecological monitoring—poses the task of designing an information base for evaluating the state of natural substances and the forecasting of changes over a long period of time for an existing or increasing technological load. Thus, the analytical tasks are extremely varied both in volume and content.

The analytical chemist must determine the total effect of technology on all the enterprises of a region and possibly the nearest neighbor (for example, the problem of the maintenance of Yasnaya Polyana). Many of the supertoxicants are not direct but indirect results of technology.

Analytical instruments suitable for ecological control are not suitable for monitoring.

The goals established for monitoring can be achieved only by using analytical systems based on universal methods of chemical analysis: gas and ion chromatography, X-ray diffusion, optical spectroscopy (including Fourier IR), and also chromatomass spectroscopy.

Work on state scientific-technical programs began more than 10 years ago. Now instruments for solving analytical problems will be mass-produced.

An analytical system is a rather new concept. Russian-built instruments such as chromatographs, spectrophotometers, and X-ray fluorometers require highly skilled analytical chemists. Because of the lack of properly trained personnel, chromatographs have been issued with empty columns, spectrophotometers have been without apparatus for analyzing not only liquid but also solid and gaseous phases, and needed programs have been lacking for identifying compounds. Thus, the problem of achieving "unique and correct analytical measurements" become practically insolvable.

The design of an analytical system is a direct alternative to the above. The analytical system is a completely finished product, ready for use in a wide range of applications. Involved are supplementary equipment, automated sampling, sensors, reagents, and consumed materials. State certification directly affects the metrological characteristics of the methods used. On the basis of this, information has been developed for a list providing needs for a year.

A computer chromatographic system is described which uses an IBM PC/AT. It is used for controlling acetone, toluene, benzene, o- and m-xylene, ethyl acetate, butyl acetate, and butanol in the air of the workplace. An ion chromatographic system is used to analyze air in the workplace containing acid and basic gases and vapors. Another ion-chromatographic system is used for analyzing anions and cations in water. An X-ray fluorescence system measures metal and other cations. A spectrophotometric and spectroluminescent system consists of two parts for analyzing gases in air. A specialized method is used for automatic sampling of gases and water. The gas analytical apparatus undergoes testing for accuracy.

The central laboratory has an IBM PC/AT-486 (without radio communication), modems, interfaces between the central computer and computers of the analytical systems, a machine-readable library, and links between the central laboratory computer and user computers.

The advantage of compatibility makes it possible to do any analysis by two independent methods. In one to three years more than 300 such systems should be in operation in Russia.

In 1994 work is being done on developing a base for systems of laboratories for ecological monitoring and control. In 1995 more than 60 large and small enterprises will have mass production of analytical systems and representative laboratories.

Development of Automated Systems of Ecological Protection of Air and Atmospheric Emissions

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9 Sep 94 pp 18-20

[Article by Ye. K. Prokhorova and O.M. Khobotova, engineers]

[FBIS Abstract] The most effective means for controlling atmospheric pollution are automatic analyzers. Of the 1500 highly dangerous substances in the air of the workplace, it is possible to control less than 20 by means of automatic gas analyzers.

The problem of automatic control of the air has not been solved due to the multicomponent nature of the environment being measured, the high cost of the development and organization of the production of automatic analyzers, their metrological provision, and high operating costs. Therefore, automatic control instruments are lacking both abroad and in Russia.

Two kinds of methods are needed for control: sampling and laboratory analysis (physicochemical methods such as chromatography, electrochemistry, photometry, chromatomass- spectrometry, etc.).

In the design of sampling apparatus, particular attention is paid to:

- small size and mass, permitting ease of mobility;
- use of different sources of input;
- development of different sampling programs over time and yield of air;

- high precision;
- possible use of absorbent apparatus;
- achievement of the corresponding contemporary level of automation.

The M-822 aspirator has been widely used up to now. It is small and simple but can not be used for environmental control. It is subject to error and has a low degree of automation, low productivity, and limited applications.

LEK instruments, which are analogs of the M-822, are not certified and are not recommended. EA type semiautomatic electroaspirators simplify the work in comparison to the M-822 but cannot be widely used. The Komponent apparatus has high reproducibility but is built to work with only one type of absorbent. The EA and Komponent apparatus can be used only in stationary laboratories or as a component of mobile laboratories. They are produced only within Russia.

At the present time the Khimko Scientific Production Society Khimavtomaticka has developed a new generation of air sampling instruments meeting contemporary requirements. Six of these instruments are described in tabular form. Five are portable.

The characteristics of these instruments are:

- high precision;
- technical and ecological certification;
- metrological support;
- meeting of government standards;
- contemporary design;
- compact construction;
- convenient use;
- usability for different sources being analyzed;
- stability of indicators over long use;
- simplicity of design;
- service maintenance.

The PU-1E, -1Ep, -2Ep, -3E, and -4E are intended for single or daily tests of atmospheric air. They are used to control the air of the workplace and sample gases, vapors and aerosols. They can be used under high temperature conditions and meet Russian government standards. The pneumatic instrument PU-1P is used to take samples at explosive sites. PU-1P and -1E have automatic correction for resistance of the absorbent. PU-1E is a stationary instrument with a quartz timer. The apparatuses have auxiliary elements: a condensate collector, a filter for removing coarse particles, and a probe for taking samples at elevated temperatures and dust content.

The PU-3E instrument can take one to five dust samples simultaneously.

The production of PU-BE for sampling aerosols and exhaust gases of industrial enterprises is expect to begin in 1995.

Tables 1; references: 2 Russian

Pneumatic Systems for Correcting the pH Parameter of Apparatus for Purifying Industrial Effluents of Electroplating Enterprises

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9 Sep 94 pp 20-26

[Article by V.S. Bezmenov, engineer, and A.A. Tagayevskaya, candidate of technical sciences]

[FBIS Abstract] The electroplating industry uses complex chemical engineering processes requiring the use of a large amount of chemical reagents and water. A considerable volume of wastewater is formed containing both valuable and dangerous components, including heavy metals, which are injurious to the soil and are carcinogenic to humans.

Chemical reagents are the main method used in the Russian Federation to treat industrial wastewaters; all the other modern methods (electrochemical, physicochemical, ion-exchange, and membrane) also require the introduction of reagents at various stages, for which specialized dosing devices are needed. Dosage instruments in current use have a low technical level and are unreliable.

Wastewaters from electroplating enterprises can be divided into three groups:

- waste solutions from chemical operations (etching, degreasing, removal of protective embossing, chemical copper plating, etc.);
- they amount to 8 percent by volume of the wastewater and contain a 40 percent loss of nonferrous metals and chemicals;
- concentrated wastewaters from the electrochemical treatment of metals and their alloys (the application of galvanic coatings, electropolishing, anodizing, electrochemical degreasing, and etching), released periodically according to regulation of the process;
- wash waters constantly entering a purifying facility;
- they comprise 90 percent of the wastewater volume and a 50 percent loss of valuable chemicals.

Depending on the impurity content, all wastewaters are divided into cyanide-, chromium-, and fluorine-containing acid or base- containing solutions Cyanide, chromium, and fluorine-containing water must be removed from the place where they are formed and treated locally, after which it is possible to consolidate them with acid or base-containing waters for combined neutralization and removal of heavy metals.

Because of the large amount of impurities, various purification methods are used, such as mechanical, physicochemical, chemical, electrochemical, ion-exchange, and membrane, sometimes in combination.

One of the most common methods, reagent purification, has a number of deficiencies such as the use of expensive and scarce reagents, an increase in the total salt content

of wastewaters, the formation of a considerable amount of residues, and the loss of expensive substances.

Electrochemical methods have been used more widely recently. As the pH becomes more acidic, heavy metal hydroxides are precipitated, and heavy metal ions are adsorbed by iron and chromium hydroxides.

The best electrochemical method is galvanocoagulation, which can be a one-stage or a two-stage method. Its advantages are high purification effectiveness, a reduction in the salt content of the wastewater, and low consumption of electrical energy.

The Russian Academy of Sciences in Moscow has conducted research for some years on a system of pneumatic automatic control of processes for purifying wastewater. A patent (1,435,945) has been issued for a slide-valve pneumatic dosing apparatus for montejus type liquids. A schematic diagram is presented.

The main advantages of the system of slide-valve dosing of reagents are as follows:

- extremely wide range of dosing achievable due to the programmed regulation of pressure;
- high dosing precision;
- good dosing apparatus productivity;
- the possibility of achieving a system of automatic regulation of the parameters of the water purification process by using different algorithms;
- the capability of a dosing device to work with a small counterpressure;
- the possibility of using a device with pneumatic control.

However, experience with the use of systems of slide-valve dosing for chemically aggressive acid- or alkali-containing depleted solutions showed that the pneumatic elements of the control device needed corrosion protection. For chemically aggressive media, additional processing by control devices is required. In addition, the solution being dosed should come from a closed reservoir-montejus located below the point where the liquid being dosed is introduced. This is not always possible.

A schematic diagram of a dosing apparatus of the throttle type is shown which can be used both in batch and continuous processes.

The dosing apparatus contains the following apparatus:

- the command apparatus implementing the sequence of process operations and consisting of regularly organized blocks of logical conditions, operational indications, and yields. The operational indications implement the sequence of automatic operations. The block consists of an assembly of memory elements—the triggers—with separate inputs corresponding to the number of the nodes of the operation graph. The triggers are connected to each other so that the output signal of each preceding trigger connects with the next trigger. The output block contains either unconnected triggers with separate inputs or simply logical elements.
- Control apparatus which may contain a timing device.
- A block of null detectors intended to compare analogous pneumatic signals and convert them into discrete signals.
- A block of functional transducers containing a number of additional nonstandard units which participate in the formation of conditions of transition from operation to operation and the readout of the output signals of the control device.
- The control desk includes hand control devices (pneumotumbler switches and pneumokeys), adjusters (regulatable throttles, hand set point adjusters, and repeaters with a motor).

The automatic dosing system is planned according to the following steps:

- On the basis of the description and analysis of the dosing requirements, the number of null detectors and timing devices is determined, and a graph of process operations is drawn up.
- Equations of the functional blocks of the command devices are calculated.
- The principal layout of the control desk is developed which determines the connections between blocks and comprises the functional layout of the system of automatic dosing.
- An apparatus is selected for implementation of the control device, and its functional blocks and elements are arranged on the elements of the apparatus selected.
- The corresponding equipment (unit framing, consoles, cabinets) for placement of the dosing apparatus is selected.
- The layout for installation of automatic dosing system is drawn up.

The planning method described can be simplified for small operations. The automation of the majority of facilities for purifying industrial wastewater which is based on pneumatic automation involves the use of specialized montejus and throttle type dosing devices with a supplementary dosing reservoir. The advantages of automating dosing are:

- a high reliability for work in aggressive and polluted media;
- a wide range of dosing both in dose volumes (batch) and productivity (continuous);
- low dosing error rate;
- the possibility of remote control of dosing processes;
- simplicity of use and ease of combining dosing control with electronic measuring and control apparatus

Figures 5, references: 6 Russian

Experience With the Development and Adoption of the Ekolog Automated Workplace

957F0052 Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9 Sep 1994 pp 26-28

[Article by V.S. Sherman, candidate of technical sciences, director of the NTTs SAU-60 All-Union Scientific-Research and Planning Institute]

[FBIS Abstract]The functioning of state environmental services at various kinds of enterprises has its own characteristics and structure and is determined both by the size of the enterprise, the products produced, and its territorial distribution, as well as some traditions residing in various branches. The combination of environmental services with chemical laboratories carrying out environment control (or their separateness) affects the technical requirements for the Ekolog automated workplace developed for industrial enterprises. The main user of such a system is the state environmental services; responsibility for its functioning, the organization of basic data bases, their objectiveness, and pilot studies are their mission. As a rule, staff members of the environmental services do not have sufficient experience with computers and do not know adequately the particulars of a systematic actualization and storage of data bases and are unacquainted with other aspects of work in a paperless electronic technology.

Therefore, principles are being established which permit the user to master the system rapidly, to work under conditions of an amicable interface, and obtain documents from the system corresponding to the needs of statistical accounting of the departments and the enterprises.

A diagram of the Ekolog automated workplace is presented. In it are incorporated the implementation of information monitoring, its systematization and arrangement of the data base; work with data for producing the corresponding documents within the framework of the necessary time restraints (daily, monthly, quarterly, yearly reports), calculation of costs of emissions, effluents, and wastewaters; calculation of the volumes of production output not exceeding allowable harmful emissions; making the necessary corrections in standards for the modernization of production, the introduction of new plants and technologies; the processing of information inventorying the sources of harmful emissions from enterprises, and the application of changes where necessary.

FoxBase is used with a menu designed according to a functional principle. It gives the user clear and rapid access to the needed section. The system is provided with the necessary reference and help functions.

The Ekolog automated workplace can function under conditions of traditional environmental monitoring (analytical laboratory control) and automatic monitoring of the control points.

The instruments normally used are of the types IBM PC 286, IBM RAM, 40 MB HDD, 1- , 2- , and 1.44 MB FDD, VGA, I/O Ports.

The program has 1 Mbit, and the data base can occupy 10-20 Mbits of the HDD memory.

The system is used at the following enterprises: Azot, Soreal, AZLK, ZIL, the Roshalsk Chemical Combine, the Podolsk Cable Plant, the Klinvolokno Corporation, the Metallurgical and Machine-Building Plants at Elektrostal, and the Kuskovsk Chemical Plant. Adoption by other plants is anticipated.

Figure: 1.

MSKU M Microprocessor System of Management and Control

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9 Sep 94 pp 28-31

[Article by V.G. Rakitin, engineer, chairman of the board of the Impulse Corporation, A.B. Ayzenberg, V.V. Yeliseyev, G. Yu. Pivovarov, candidates of technical sciences, and V.I. Makarov, engineers]

[FBIS Abstract]The Impulse Scientific Production Association in the city of Severodonetsk has been producing computers and systems based on them for more than 30 years.

In the 1970's the M6000 system of integrated control was widely used; in the 1980's, the SM-2M and the TVSO. Even in those years the computers were connected in a local network.

The basic type of connection in such systems was a point to point network, but the systems themselves were designed according to a centralized principle—with a well-defined hierarchy and the separation of the date processing and control units.

The PS1001 system (at the end of the 1980's), inheriting the M6000 and SM-2M architecture, had a basic central processor with the necessary peripherals and a microprocessor subsystem of management and control (MSKU), which was based on the 18086 microprocessor. The PS1001 had good reliability.

The first tests of the use of the PC1000-MSKU systems at the Kirishi and Zaporozhe State Rayon Power Plants showed the trend of the ASUTP (Automated System for Control of an Educational Process) in Moscow and Kharkov to redistribute control functions along the network units. Because of various factors, it was found that modernization of MSKU was necessary.

The design of compact, reliable, rapid and superfast systems with excellent graphics possibilities predetermined the transition to a completely distributed decentralized microprocessor system of management and control—the MSKUM, assembly line produced since 1992.

The basic distribution systems of the MSKU M are a local MAPS network. The MAPS are designed according to a star topology. The arbitrator controls it by means of sequential assignment of the token to the user. Coaxial cables and fiberoptic cables are used for the network media. The users are connected only to segments based on coaxial cables. Segments based on fiberoptic cables can be used only for connection between segments of coaxial cables.

For the highly reliable MSKU M systems, the MAPS network is designed with redundant configurations with duplication or triplication of the network equipment, including the network controller.

In systems with a small volume of transactions, and also in systems with remote users, different MSKU M elements can be connected by telephone lines.

Work stations can be purchased or built on site. Different keyboards and other equipment are discussed.

A chart describes the characteristics of the MAPS network:

- Transmission capability of one bus: 1 Mbits/s;
- Maximum number of users in the network: 62;
- Maximum distance between two network users: 11,200 m;
- Clock precision, 2 ms.

The modules make it possible to receive average level voltage and current, low-level voltage, and thermocouple and thermoresistance signals; to measure the effective values of the current and voltage, the active and reactive power in alternating current networks, synchro signals, and rotating and differential transformers; to receive frequency and differential transformers; to receive frequency, number impulse, time impulse signals, and discrete and discrete initiative signals; and to generate current and voltage signals, and discrete solid state and relay signals.

The transformation errors of MSKU are in the limits of 0.2-0.5 percent, depending on the type of signals received and generated.

Any IBM-compatible personal computer can be used including a Laptop. The MSKU M guarantees maximum effective use of the system, maintains distributed processing in multicomponent control systems with a hierarchal structure, is designed as an open system permitting further development, and uses personal computers which are capable of programming, including graphs. The chemical, metallurgical, machine-building and other industries can use MSKU M.

The characteristics of the use of the MSKU PS1001.9 are given in chart form for one to three control units.

First-stage programming was begun in 1992-1993. Second stage programming is planned for 1994. A single integrated medium for all technological programming languages will begin in 1995.

Work is continuing on the expansion of the functional possibilities of packets of display of information and control for operator stations and libraries of functional modules for programming languages and raising the level of user service.

The directions of further research are described.

Tables: 2.

Structure of an Information Measurement Network for Regions of Radiation Contamination and Apparatus for Achieving It

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9 Sep 94 pp 32-34

[Article by T. G. Samkharadze, engineer]

[FBIS Abstract]The basic purpose of an information measurement network in regions of radiation contamination is to help control changes in radiation conditions. The network collects and processes a sufficiently large volume of primary information from a group of sensors. Some variations in the structure of the local measuring network are possible depending on the amount of radiation contamination. The local networks most commonly have either a star-shaped (radial) or a "chain-like" structure. The results of local measurements are sent to a zonal center for compilation and analysis. The zonal results are sent to a regional center.

It is possible to connect any user by telephone with rayon and central centers by special automatic means.

A schematic diagram of the information system is presented. The number of blocks of sensors in a unified system varies from 1 to 1024, and the number of sensors in a single block from 1 to 16. The maximum number of sensors in a unified system is 16,384. The intensity of α, β, and γ radiation and the concentrations of harmful contaminants in the air and soil are measured.

The unified system works as follows. The periodicity and sequence of the monitoring of the sensors is programmed. Depending on the command coming from the central control to the input-output ports, the second block connecting to peripherals completes the operation of selection of one of the commutator control blocks and transfers data to it about the required connection with the corresponding commutators. The commutator control block selected carries out the operation for establishing the connection. This leads to switching of the data transmitter to one or several analog converters.

The analog signals are converted to codes corresponding to the values of the parameters measured by the data transmitter. The data is stored in the memory of two computers. The results of the information sent to the two computers are compared and analyzed for discrepancies.

The experimental tasks can be extremely varied. Thus, situations can be measured and analyzed which are characterized by a one- time change in several physical parameters: temperature, pressure, humidity, radiation, or a combination of them. The system becomes universal. It is possible to determine the concentration of harmful substances in the

soil formed by the action of acid rain. The seismic state of the earth can be measured by vibrating instruments.

The system has been developed and implemented and is ready for use.

Figures: 2.

Automated System of Ecological Monitoring

Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 9 Sep 94 pp 34-36

[Article by V.V. Rogozov, candidate of technical sciences, director of the State Institute for the Design and Planning of the Automation of Coal, V. Ye. Bogin, candidate of technical sciences, and A.M. Smirnov, engineer]

[FBIS Abstract]On 24 Nov 93 the Russian Federation Council of Ministers determined the tasks for the establishment in Russia of a Unified State System of Ecological Monitoring (YeGSEM). The Russian Ministry of Fuel and Energy is entrusted with implementing a system of observation and control of emissions and effluents of harmful contaminants into the environment from enterprises, organizations, associations, and other sources of anthropogenic actions. The State Institute for the Design and Planning of the Automation of Coal is developing a branch system for automated ecological monitoring.

The basic contaminants are:

- for the water basin—suspended substances, petroleum products, biological requirement for oxygen, phenols, dry residues (sulfates, chlorides, iron);
- for the air basin—dust and ash, gaseous (sulfur dioxide, carbon monoxide, nitrogen dioxide, hydrogen sulfide, and also methane, nitric oxide, and carbon dioxide).

In addition, it is proposed to control deformation of soils, radiation conditions (in particular, radon in water and rock tailings), and noise, and also to monitor the mine shafts.

The structure has three levels. On the lowest level is a system of automated ecological monitoring of the enterprises. More than 20 years of research at the Coal Experiment Station in Perm has shown that the coal industry has an unfavorable effect on the environment. The Russian Federation Ministry of Natural Resources found it ranked sixth place in Russia.

The total expenditures of the coal industry for ecology have reached 60 billion rubles, including fines of 20 billion rubles per year. A system of ecological monitoring should reduce these expenditures to 3-5 billion rubles, chiefly by reducing fines. The main sources of pollution are from coal mine shafts, coal open pits, and coal-concentrating factories. The effects of each are listed in a table. Each system has measuring instruments and programmable controllers for processing the measurement information. The controllers are connected by modems with a central controller connected to a computer. Measuring instruments include automatic gas analyzers, dust measurers, analyzers for measuring suspended substances in wastewaters, conductometric analyzers, measurers of electrical conductivity, radiometers, instruments for measuring soil dislocations, noise meters, etc.

The work is performed at the automated ecology workplace of the enterprise. It has numerous responsibilities including safety monitoring, automatic control of water and gas purification processes, and an integrated system of management of the enterprise. Background values of contaminants and data on meteorological conditions are obtained. Laboratory measurements are automated.

The middle level of the system includes the basin (regional) centers and the scientific-research centers. They collect and analyze information from systems at the enterprises, perform laboratory analyses periodically, and plan measures for conservation of the environment, financed by regional funds.

The basin centers are connected to the basin centers of other branches and also with the branch ecology center placed at the top level of the system.

The branch ecology center collects data from the basin centers and provide data to the Russian Federation Ministry of Natural Resources and branch centers of other branches.

All the work is conducted under the guidance of the State Institute of Applied Ecology of the Russian Federation Ministry of Natural Resources, which is the basis of a federal automated system of information and analytical control. Its regional functions are performed by Ekologiya centers, which use instruments and methods certified by the Russian Federation.

The tasks of the systems for automated ecological monitoring of coal enterprises include:

- verification of the adequacy of the measured and calculated indicators in order to reduce their numbers;
- study of the dynamics of the indicators and their correlation with the production process parameters (primarily with the quantity and quality of the coal mined);
- evaluation of the possibility of using subflame systems of control of emissions and effluents for developed regions beyond the public health area of the enterprise.

The direct economic effect will be to reduce expenditures for the use of natural resources, to decrease penalties, and reduce the volume of harmful emissions and effluents.

Such systems have an important role for enterprises close to other major sources of pollution: chemical and metallurgical combines, large thermal electric generation stations, and petroleum refining enterprises.

Experimental Clinical Study of Efficacy of Kerakol in the Treatment of Burns and Mechanical Traumas of the Cornea

957C0083A Moscow VESTNIK OFTALMOLOGII in Russian Vol 110 No 3 Jul-Sep 94 [manuscript submitted 16 Apr 93] pp 5-7

[Article by Senior research associate V. K. Surkova, Z. A. Gilyazeva, L. R. Talipova, Ufa Scientific Research Institute of Eye Diseases; UDC 617.713:616-003.93:612]

[FBIS abstract] The inadequacy of the medications used to promote biostimulation of corneal repair processes has led to the development of new so-called biostimulators, such as the medication under study here by the Ufa group—kerakol. Kerakol is obtained from cattle corneas and is a highly specific corneal glycosamine glycan—keratan-sulfate I and native-cornea' collagen. It is an amorphous, yellowish powder that is rehydrated by lacrimal fluid or by solutions of medicinal preparations. Because kerakol accelerates regeneration and clarifies the cornea, it is used for, among other things, burns, ulcers, and fistulas. It is manufactured by the Ufa NPO Immunopreparat and has been approved for clinical use. The Ufa group of researchers used the medication locally in 138 patients with chemical or thermal burns of the eye, traumatic keratitis, traumatic corneal ulcer, or erosion. With kerakol, healing of the burn surface was faster than in control: there was a less pronounced inflammatory infiltration, more rapid epithelialization with earlier differentiation of the epithelial cells, and earlier restoration of the stroma, all of which promoted rapid maturation of the collagen structures and proper orientation. ^{3}H-thymidine levels were higher in the cells of the damaged tissue. Similar effects were noted for mechanical damage. The use of kerakol cut treatment time by an average of 3 bed-days. Some 74 percent of experimental patients with chemical burns of the cornea were released from the hospital with a visual acuity of 0.6-1.0, as opposed to 67 percent in the control group. The figures were 78 percent and 56 percent, respectively, for thermal burns and 83 percent and 74 percent for corneal traumas. Figures 2, references 4 (Russian).

Specific Nature of Combat Trauma to the Eyes in Peacetime

957C0083B Moscow VESTNIK OFTALMOLOGII in Russian Vol 110 No 3 Jul-Sep 94 [manuscript submitted 20 Aug 93] pp 7-10

[Article by Professor R. A. Gundorova, Dr. Med. Sci. A. V. Stepanov, Research associate O. I. Kvasha, Cand. Med. Sci. L. Ya. Polyakova, Cand. Med. Sci. G. G. Petriashvili, Moscow Scientific Research Institute of Eye Diseases imeni Gelmgolets, Ministry of Health of the Russian Federation; UDC 617.713-001.45-089]

[FBIS abstract] Most of the information available on this subject in the former Soviet Union dates from World War II. That prompted the researchers here to perform a retrospective study of the case histories of 203 individuals who received wounds to the eye in local conflicts that have sprung up in the former Soviet Union in an attempt to provide data that is more up-to-date and will thereby help the local medical officials who must treat such wounds to be better prepared. Some 90 percent of the wounded were brought in with penetrating wounds to the eyes, with 62 percent involving a foreign body lodged in the eyeball or the orbit. The foreign bodies in 96 percent were brass, aluminum, or lead. Some 24 percent of the wounded had perforating wounds of the eyeball. Twenty percent had bilateral wounds. A large percentage of the wounded evidenced a polymorphism of eye damage, which showed up in combination with traumatic alterations of the optical media, with severe damage to the visual analyzer. Almost 12 percent of the wounded suffered infectious complications. The researchers recommended the following: the wounded should be evacuated as quickly as possible to the nearest ophthalmology facility; primary ophthalmology care should be given as quickly as possible, and primary surgical treatment of the wound should be mandatory; no attempts should be made to remove foreign bodies during the primary surgical treatment of the wound in the local medical facilities; the wounded should be rushed to an ophthalmology trauma center after the wound is treated surgically. References 5: 3 Russian, 2 Western.

Effect of Sodium and Ouabain on Activation of β_2-Adrenoreceptor-Dependent Adenylate Cyclase of Human Lymphocytes

957C0100A St. Petersburg TSITOLOGIYA in Russian Vol 36 No 1 Jan 94 (manuscript received 4 Dec 92) pp 104-110

[Article by T.L. Krasnikova, A.S. Khollister, and P. Brubeyker, Cardiology Research Center, Russian Academy of Medical Sciences, Moscow, and Clinical Pharmacology Department, Health Sciences Center, University of Colorado, Denver]

[FBIS Abstract] The inhibitory effect of sodium ions on the adenylate cyclase activity of human lymphocytes was examined in a series of experiments performed on mononuclear lymphocytes obtained from the peripheral blood of healthy donors. Adenylate cyclase activity was determined in lymphocyte homogenates by the method of Salomon et al. (1975) as modified by Panchenko et al. (1985), with α-^{32}P-adenosine triphosphate serving as a substrate. The effect of ouabain on sodium inhibition of adenylate cyclase activity was studied by stimulating the enzyme through the β_2 receptor by l-isoproterenol (0.1 mM) and by activating the G_s-protein by using the nonhydrolyzed analogue guanosine triphosphate-5'-guanylyl imidodiphosphate Gpp(NH)p (0.01-0.001 mM), NaF (10 mM), and cholera toxin (5 μg/ml). The lymphocytes were stimulated in the presence of ouabain (0.1 mM) and with no ouabain present (the control experiments). Adenylate cyclase sensitivity to sodium

ions differed for each of the methods used to stimulate adenylate cyclase activity. The sodium half-maximum inhibitory dose (ID_{50}) was lowest (approximatley 40 mM) when l-isoproterenol was used to stimulate adenylate cyclase activity. Cholera toxin did not affect the inhibition of adenylate cyclase by sodium. Ouabain had virtually no effect on sodium inhibition of adenylate cyclase basal activity: When l-isoproterenol was used to stimulate adenylate cyclase, ouabain (in quantities of 10 to 100 μM) increased the ID_{50} by a factor of 1.5 (to 64.0 +/- 8.29 mM). No change in sodium ID_{50} was observed when adenylate cyclase activity was stimulated by either Gpp(NH)p, l-isoproterenol plus Gpp(NH)p, NaF, or cholera toxin. The ID_{50} was decreased after brief (15-minute) l-isoproterenol activation of intact lymphocytes. It was hypothesized that ouabain's effect on sodium inhibition of adenylate cyclase activity occurs through the β_2-adrenergic receptor. The fact that ouabain only affected sodium inhibition of adenylate cyclase activity when l-isoproterenol was used as an activator was taken as an indication that ouabain acts on some segment(s) of the receptor itself, possibly the segment that includes aspartate-79. Figures 2, tables 2; references 27: 2 Russian, 25 Western.

Scientific and Organizational Principles of Aftercare for Children Exposed to Chernobyl Hazard

957C0101 Moscow VOPROSY KURORTOLOGII, FIZIOTERAPII I LECHEBNOY F IZICHESKOY KULTURY in Russian No 4 Jul-Aug 94 pp 39-42

[Article by N. P. Drinevskiy, Ukrainian Scientific Research Institute of Children's and Health Resort Treatment and Physiotherapy, Yevpatoriya; UDC 616-001.28-053.2-082]

[FBIS Abstract] The most important problem facing health care organizations and the government is minimizing the negative consequences of small doses of ionizing radiation. Every year the number of children entering health care facilities in Yevpatoriya increases. A total of 364 adults who aided in the Chernobyl clean-up and 104 of their children reside in Yevpatoriya. Specific physical and psychological symptoms found in children exposed to low doses of radiation are enumerated. These children require careful observation and treatment. Despite large government expenditures, little has been done to protect residents from radiation or to improve health maintenance and enhancement services. No work has been done to make diagnosis, treatment, and follow-up evaluation systematic. No specialized treatment services have been created. Efforts must be made to organize, standardize, and document treatment. It is recommended that histories and evaluations of current conditions be compiled for each patient based on a standardized evaluation procedure. Psychiatric treatment must be better organized. Past treatment methods must b e evaluated for effectiveness; indications and contraindications for the use of various treatments must be compiled.

Molecular Biology-Based Methods of Detecting and Identifying Microorganisms in the Environment

957C0104A Moscow BIOPOLYMERY I KLETKA in Russian Vol 10 No 3-4 May-Aug 94 (manuscript received 23 Feb 94) pp 5-23

[Article by N.A. Kozyrovskaya and G.L. Kovtunovich, Molecular Biology and Genetics Institute, Ukrainian Academy of Sciences, Kiev, Ukraine; UDC 579.25]

[FBIS Abstract] Only approximately 20 percent of the microorganisms populating the biosphere are known to science at the present time. The others cannot be detected by conventional methods. From an epidemiologic standpoint, it is extremely important that disease-causing microorganisms be monitored, especially wild microorganisms and microorganisms that have undergone genetic alteration as a result of adverse environmental conditions. Before the possible consequences of the release of genetically altered microorganisms into the biosphere can be predicted, scientists must develop reliable methods of observing not just genetically altered microorganisms themselves but also their DNA released after cell death. Because it is protected from the effect of endonucleases, this DNA retains its biologic activity after a microorganism cell has died and can, under favorable conditions, become a part of the bacteria transformation process more rapidly than ever before assumed. Conventional methods of isolating and identifying microorganisms are cumbersome and laborious and have a low efficiency because most microorganisms cannot be cultured. Molecular biology- and genetics-based methods of detecting and identifying microorganisms have been demonstrated to be promising ways of quickly identifying bacteria in specimens gathered from the natural environment and studying the structure and dynamics of populations in a natural microbe community. Information regarding the structure of genes and their nucleotide sequences, coupled with the development of new molecular biology methods, has made it possible to identify microorganisms in natural ecosystems by using genetic markers. Nucleic acid analysis (involving the use of nucleic acid probes) has made it possible to isolate genetic markers in a microorganism's chromosome or extrachromosomal DNA. Initially, chromosomal DNA of known bacteria serves as the DNA probe. More recently, however, more specific DNA probes based not on a chromosome but on specific genes localized on plasmids have been hybridized and used. Hybridization of DNA colonies with a specific probe has permitted quick identification of microorganisms in microbe communities in quantities of 10^3-10^6 cells per gram of sample. In the past 5 years, polymerase chain reaction [PCR] has proved to be valuable in identifying microorganisms present in the environment in small quantities. PCR amplification of the specific genetic marker of genetically altered microorganisms has become a powerful tool for monitoring the viability of such microorganisms in the environment and their propagation in new biocenoses and for detecting the presence

in specimens of a specific mRNA indicating expression of a genetic marker. New variations of PCR such as randomly amplified polymorphic DNA [the RAPD method] in conjunction with other identification methods, specifically, pyrolysis of microorganisms followed by mass spectrometric analysis, have made it possible to identify new bacterial strains (such as *Bradyrhizobium japonicum* CB 1809) that would previously have remained undetectable. Ribosomal RNA sequences have also been used for quick identification of microorganisms. Two additional new ways of detecting and identifying microorganisms based on the use of reporter genetic markers involve the use of chromogenic and bioluminescent genetic markers. These new methods are permitting great progress in the field of monitoring wild and genetically altered microorganisms and will help make it possible to conduct field studies of genetically altered microorganisms and their eventual use in agricultural production. References 119: 5 Russian, 114 Western.

Ecological and Epidemiological Analysis of Allergic Diseases of Children in Orenburg

957C0106A Moscow GIGIYENA I SANITARIYA in Russian No 7 Jul-Aug 94 (manuscript received 12 Apr 94) pp 3-5

[Article by V. M. Boyev, O. G. Pavlovskaya, M. N. Volyanik, V. V. Bystrykh, V. F. Kuksanov, Orenburg Medical Institute , City Center of Public Health and Epidemiological Control; UDC 616-056.3-053.2-02:614.7].07]

[FBIS Abstract] Data is presented on the relationship between allergic diseases in children and the level of air pollution in Orenburg. In 1988-1993, NO_2, H_2S, and formaldehyde levels increased. In some regions concentrations of these substances exceeded the maximum allowable concentration (MAC). Individual regions of the city differed qualitatively and quantitatively in terms of pollution. The concentrations of metals such as chromium, lead, and zinc substantially exceeded the MAC. Key polluters and pollutants are listed. The overall incidence of allergic diseases was 121.38 per 1000 children. Figures are presented for specific respiratory ailments and allergic reactions. The area with the highest pollution level also had the highest level of allergic diseases, although a region indicated as having a low level of air pollution had the city's highest incidence of asthmatic bronchitis. Standardized epidemiological studies to determine the distribution of allergic diseases in children and evaluate the effect of air pollution distribution revealed that the incidence of allergic disease is affected not only by air pollution, but also by a complex of ecological factors. Data on the distribution and instances of allergic disease were comparable with other cities in other areas of the country. Tables 3; references 10 (Russian).

Structure and Level of Consumption of Main Food Substances of the Able-Bodied Adult Population of Altay Krai

957C0106B Moscow GIGIYENA I SANITARIYA in Russian No 7 Jul-Aug 94 (manuscript received 4 May 94) pp 10-11

[Article by A. V. Istomin; F. F. Erisman Moscow Scientific Research Institute of Hygiene; UDC 613.2-053.8-07 (571 .15)]

[FBIS Abstract] The eating habits of the adult population of two Altay districts was studied. It was found that the protein: fat:carbohydrate ratio was 1:1.3:4.7 for men and 1:1.3:5.2 for women. Adults were found to eat too much starch (bread and pasta products) and had an insufficient intake of animal proteins, vegetable oil, some vitamins and minerals, and iodine. There was a deficiency of seafood, fresh fruits and vegetables, and berries in their diets. Recommendations were developed to improve diet to meet nutritional requirements. Tables provide information on caloric intake by food group and vitamin and mineral levels. Tables 2; references 5 (Russian).

Ecological Situation and Morbidity of the Population of Zaporozhye

957C0106C Moscow GIGIYENA I SANITARIYA in Russian No 7 Jul-Aug 94 (manuscript received 5 Apr 94) pp 24-26

[Article by I. I. Tokarenko, V. Ya. Ivanov, Zaporozhye City Center of Public Health and Epidemiological Control; UDC 616.1/.9-02:614.7]:313.1 3]

[FBIS Abstract] The severe pollution situation in Zaporozhye is outlined. Data are compiled on morbidity and mortality and the data are compared with other regions of Ukraine. Pollution has had an extremely negative effect on the health of the populace, in particular, the children. The incidence of various respiratory diseases in children is much higher in Zaporozhye than elsewhere. Zaporozhye has the highest newborn mortality rate, and the number of children who die before the age of 1 reaches 16 per 1000, which is 10% higher than the value for the republic as a whole. The pregnancy rate in 1992 was down 36.0% compared to 1986-1991. The total population growth per 1000 was 10.3; the birth rate per 1000 was 11.4, mortality 10. 9, and natural growth 0.5 due to pollution and the severe worsening of living conditions. Statistical analysis revealed direct correlations between certain diseases, individual pollutants in the air and drinking water, and meteorological parameters. Findings are presented for children and adults. A better correlation was found between the incidence of disease and drinking water contents than the concentration of air pollutants. Predictions of future trends for morbidity and mortality are presented. References 5 (Russian).

Relationship Between Population Allergization and Environmental Pollution by Heavy Metals (e.g., Hexavalent Chromium)

957C0106D Moscow GIGIYENA I SANITARIYA in Russian No 7 Jul-Aug 94 (manuscript received 14 Apr 94) pp 41-43

[Article by B. V. Zasorin, Zh. A. Moldashev, T. K. Karimov, A. A. Mamyrbayev, V. M. Sabyrakhmetova, Scientific Center of Medical Research on Regional Problems, Western Division of the National Academy of S ciences, Republic of Kazakhstan, Aktyubinsk; UDC 616-056.3-02:614.7:546.76]-07]

[FBIS Abstract] The territory of Aktyubin sk oblast has a number of industries which release hexavalent chromium into the environment (9.56 tons is emitted into the air per year). The chromium content in the Ilek River varies from 175 to 668 times the maximum allowable concentration. Chromium is accumulating in the soil and agricultural products. Earlier findings on the effect of chromium on humans are summarized. This paper studies the incidence of allergies in the population of Aktyubinsk that is not directly involved with chromium or chromium derivatives. The presence and concentration of chromium is established from various sources. Control and experimental regions (15 km from the industrial zone and 1.5-2 km away, respectively) are contrasted. Figures for individual allergic diseases or groups of diseases are given for each group. Overall, 74% of those with allergic diseases were from the experimental region. A direct link was found between bronchial asthma, allergies to medicine, and sensitivity to pollen and the chromium content in the air and water. A direct link was found between the chromium content and the frequency of allergic diseases. Even minimal amounts of chromium have an immunotropic effect, a precondition for the development of hypersensitivity to allergens. Table 1; references 16: 11 Russian, 5 Western.

Improving the Work Organization of Mobile Medical Teams on Railroad Transport

957C0106E Moscow GIGIYENA I SANITARIYA in Russian No 7 Jul-Aug 94 (manuscript received 15 May 94) pp 43-45

[Article by O. N. Sorokin, A. A. Prokhorov, Medical Administration of the Ministry of Communication Lines, All-Union Scientific Research Institute of Railroad Hygiene; UDC 626-082:656.2]

[FBIS Abstract] A third of all railway workers live in regions without medical treatment and health maintenance centers. Constant monitoring of their health, working conditions, and living conditions is possible only with mobile medical units. The units include railroad cars which serve as clinics, ambulances, laboratories, decontamination chambers, and disinfection units. Current practice was studied and the opinions of specialists were gathered to develop recommendations for the organization of the medical care provided by these units. It is recommended that a special group be formed to plan, monitor, analyze, and develop measures to improve this service. The units should have data that include epidemiological, ecological, and demographic studies. The mission of each medical team that is sent out should be clearly formulated, as well as the complement of units to be dispatched. Long- and short-term planning and emergency preparedness must be considered. Specialized teams (e.g., oncological) should be created. Examinations should be standardized by age group. A profile of each settlement serviced by railroad units should be compiled. An automated information and reference system has been developed for mobile units to improve planning and administration of the work of the mobile railroad medical units.

Ecological and Hygienic Problems of Destroying Chemical Weapons (Survey)

957C0107A Moscow GIGIYENA I SANITARIYA in Russian No 7 Jul-Aug 94 (manuscript received 15 May 94) pp 36-39

[Article by O. Ye. Chepurnykh and M. M. Avkhimenko, MMA [Moscow Medical Academy] imeni I. M. Sechenov; UDC 616.7:623.4]-07]

[FBIS Translated Text]After the use of chemical weapons on the battlefields of World War I, they began to accumulate in different countries of the world. Toxic substances (TS) [gases] also began to be produced in Russia in the 1920s. The largest amount of our chemical weapons in the last 70 years can be divided into four groups: yperites, suffocating gases (phosgene and diphosgene), arsenic-containing TS (lewisite, adamsite, diphenylchloroarsine) and, finally, highly toxic organophosphorus TS with neuroparalytic action (sarin, soman and V gas). The first three groups of TS were produced in the 1920s-1950s and the fourth group, in the 1960s-1980s.

During World War II, production of all types of TS increased dramatically. Yperite alone was produced by almost 30 plants, and the capability of the yperite shops constituted 35,000 tons/year. Lewisite was produced by about 13 plants. At the present time, the stock of lewisite amounts to 6400 tons in Kambarka (Udmurtiya) and 200 tons in the village of Gornyy, in Saratov Oblast [1].

In the terminology adopted by the Convention for Chemical Disarmament, phosgene is viewed as a dual purpose chemical, i.e., under specific conditions it can be used as a useful chemical in some sectors of the chemical industry. At the present time, the Army has a small arsenal of phosgene, 50 tons in the form of ammunition [1].

There have been some changes is the attitude of military physicians toward arsenic-containing TS. They were previously viewed as irritant chemical warfare. At present, such substances are no longer a chemical weapon, and they are not even mentioned in the above

convention. However, arsenic-containing compounds are still a terrible ecological weapon against us. According to the data in [1], our navy sunk 17,543 aerial adamsite bombs at two points of the Baltic Sea between 1946 and 1978.

Equally acute is the question of destroying organophosphorus nerve gases. In all, according to official data, 12,000 tons of sarin and 5000 tons of soman were produced in our country in only a few decades. These TS were loaded in various ammunition: shells, aerial bombs (sarin) and spray tanks (viscous soman) [1].

Even larger quantities (15,500 tons) of organophosphorus TS referable to the so-called V gases were produced at the Khimprom [Chemical Industry] Production Association (Novocheboksarsk, Chuvashiya). At present, these organophosphorus gases are stored in five arsenals situated all over Russia: Kizner (Udmurtiya), Leonidovka (Penza Oblast) and Shchuchye (Kurgan Oblast), as well as Maradykovskiy (Kirov Oblast), and Pochep (Bryansk Oblast) [1]. The question of means of destroying all forms of TS is utterly unclear thus far. We believe it expedient to call the attention of our scientists, military medical officers, chemists and other specialists to how this problem is being resolved abroad, in particular in the United States.

In 1984, the Congress of the United States ordered destruction of unitary chemical weapons. It allocated funds for this operation and monitors its implementation through an inspection subcommittee of the Armed Forces Committee of the House of Representatives. In the army, the following are responsible for this operation: chiefs in the rear, administrator of department for particularly dangerous situations, labor safety practices, as well as an administrative program for destroying such weapons. The latter is in regular contact with the Federal Agency for Emergency Situations and the President's Council for Environmental Quality. The Health Department will monitor this operation, and permission for its implementation will be granted by the Environmental Protection Agency (EPA) and analogous state agencies [3]. A special program has been adopted for destruction of chemical weapons in the United States. More than 20 studies have been carried out on different variants of destruction, and there have been public hearings on these studies [4].

The U.S. Defense Department was to destroy some of the stockpile of chemicals and chemical weapons that are carried by M-55 missiles by 30 September 1994 [4]. Chemical weapons are stored at eight locations of the continental United States: in the states of Maryland, Alabama, Kentucky, Indiana, Arkansas, Colorado, Utah, Oregon, as well as Johnston Atoll in the Pacific Ocean [6].

Two programs for the technology of destroying chemical weapons have been approved by the Defense Department: one is implemented at army warehouses in Tooele, Utah, and the other is based on cryogenic treatment followed by burning, which is at the stage of research and technological development. The Defense Department is studying three alternative variants for destruction of TS. The first is to organize a single national center (if this version is chosen, the site will be Tooele due to its remote location, availability of qualified work force and storage there of 42.3 percent of the stockpile of chemical weapons); the estimated cost of such a center is 1.96 billion dollars; the second variant is to organize two centers for destruction of chemical weapons, in Tooele and at the warehouses in Anniston, Alabama; estimated cost is 1.864 billion dollars; the third variant is to destroy the stockpile of weapons at the storage site, with a center for training personnel to be built in Maryland; in this case the cost of destruction would be 1.972 billion dollars [6]. There are reports of negotiations of the US Defense Department with the EPA concerning adherence to environment-conserving legislation related to destruction of chemical weapons. This resulted in publication of a draft conclusion of ecological experts about the three above-mentioned alternative variants of destroying chemical weapons. As indicated in the report [6], analysis was carried out of the 12 main criteria:

- public safety in case of large-scale accidents,
- probability of one or more accidents,
- distribution of risk among the public,
- probability of sabotage or terrorist action,
- technological difficulties,
- attitude of the community,
- difficulty of management,
- cost of the program,
- legislative or political difficulties,
- monitoring difficulties,
- scheduling the work,
- impact on military resources.

From the standpoint of civil defense, work dealing with estimates of the risk of human deaths if a chemical penetrates into atmospheric air and water when destroying obsolete chemical weapons is of special interest. According to E. L. Hillsman and P. R. Coleman [7], estimates of deaths and injured were made at the eight sites of storage of chemical weapons and of possible routes for their transportation to special disposal sites. Routes that are remote from major cities were chosen. The risk zones were estimated for the most probable and worst meteorological conditions; the maximum number of victims in case of accident was 42,000 people. The population in zones of possible accidents was calculated on the basis of the 1980 census, i.e., somewhat arbitrarily, since this showed the concentration of inhabitants in "centroids." The data on population size are somewhat obsolete, nor do we know the difference between daytime and nighttime distribution of the population. Areas covered with gas clouds vary as a function of meteorological and topographic conditions. In the opinion of the above authors, all this makes it difficult to gain objective information and inform the community about the risk of destroying and transporting chemical weapons.

In the opinion of G. O. Rogers et al. [9], when planning programs of action in case of accidental contamination of the environment during destruction of chemical weapons one should consider the fact that, in spite of the low probability of such accidents, there will be an average of more than 500 deaths in each of them (maximum of more than 1400), since 1.9 million people reside within a 35-km radius of the 8 army chemical arsenals. Means of notification (sirens, radio, mobile phones, and others) must be available to the (army) center. A special army committee checks the extent to which the military help local authorities prepare evacuation plans and other measures to protect the public and provide technical reinforcements. The check revealed that local authorities are not always informed about the chemical hazard to their territory. The safety measures are analogous to those provided in the Program for preparing for nuclear accidents (developed by the Emergency Situation Agency and Atomic Regulatory Commission), for removal of chemicals from control (EPA recommendations) and effects of hazardous substances (group for planning emergency measures).

Considering the topography of the locality, population density and meteorological conditions around the center of a possible accident, a distinction is made of zones of active, protective and preparatory measures. Roads, junctions and bridges for evacuation must be provided at a distance of 10-35 km (downwind) from the accident site. There must be a gas shelter; schools, hospitals and nurseries must be sealed; means of evacuating the public and for personal protection must be ready. There could be early evacuation. The army has asked for 100 million dollars to help local authorities [9]. It is recommended to educate the public near each of the bases where chemical weapons are stored on the means of individual and collective protection.

A considerable number of works by foreign authors deal with investigation of processes of simulating penetration of toxic poison gases into the atmosphere and water and during transportation to destruction sites [2, 9, 10]. For example, J. E. Breck [2] believes that ecological assessment of the variants for destroying chemical poison substances should also consider the possibility of accidental spills of TS and their penetration into running water. It is necessary to estimate the range of contamination of water as far as the section line. The range will depend on the season, current velocity and other hydrological features, as well as physicochemical properties of TS. Soluble TS are neutralized rather rapidly in water, whereas insoluble ones could be captured by suspended particles. In the opinion of V. R. Tolbert and J. E. Breck [10], if a TS breaks down into droplets in water or forms a floating spot, which is typical of yperite, it is hard to predict the results since people can be affected far down river. The same applies to heavy coagulates of TS when they drop to the bottom and are drawn by silt. These same authors investigated reservoirs close to TS storage sites, as well as along the routes of their possible transportation. Forecast maps were charted, which are needed to plan preventive measures, measures to observe the quality of water into which TS could penetrate, as well as to single out zones with contaminated water, which is needed to determine restrictions as to use of water by the local population.

The US Transportation Department has published special "Rules for issuing information about action in emergency situations on transport" [8]. These rules should help drivers and railroad workers act more efficiently and competently when transporting TS and other hazardous freight. The rules make it incumbent upon the freight shippers to include in documents accompanying the freight information needed to respond effectively in case of emergency. The shipper does not have the right to ship and the transport organization does not have the right to receive freight if accompanying documentation does not contain information about how to act in emergencies. Such information must accompany the freight at all stages of transportation, and it must be readily accessible in case of accident. The following information must be included: description of TS, immediate threat to health, flammability, explosiveness, immediate precautions needed in case of accident, first actions to be taken in case of leak, spill, as well as first aid.

As a result of multilateral and multistepped ecological expert assessment, as well as a series of research projects, the US Defense Department arrived at the conclusion that it is more expedient to destroy stockpiles of chemical weapons at the sites of their storage according to the above set of criteria than to transport them to processing and destruction sites.

A group of experts formed by the Center for Disease Control approved the standards for protection of the public and personnel involved in destroying stockpiles of chemical weapons proposed by the US Defense Department. In essence these stockpiles consist of sulfuric mustard gas (yperite), GB and VX nerve gas. At the suggestion of the Defense Department, chemical weapons will be burned at the eight arsenals at their storage sites. The permissible dose of public exposure is $3x10^{-6}$ mg/m^3 (gases of the GB and VX type) and $1x10^{-4}$ mg/m^3 (mustard gas); for personnel the levels are $1x10^{-4}$ mg/m^3 (GB type gas), $1x10^{-5}$ mg/m^3 (VX type gas), and $3x10^{-3}$ mg/m^3 (mustard gas) [5].

There was an important event in January 1993 in the area of chemical disarmament: on 13 January, in Paris, Russia signed the Convention on banning development, production, stockpiling and using chemical weapons and their destruction, and more than 100 countries signed it as well [1]. Thus, our country will have to deal with destruction of chemical weapons stockpiled long ago. According to the data in this survey, this is an expensive and ecologically hazardous matter that requires participation of highly qualified personnel; for this reason, the experience gained by other countries in solving this problem may be quite useful and timely.

References

1. Voronov, V., and Fedorov, L., KHIMIYA I ZHIZN, 1993, No 7, pp 67-70.

2. Breck, J. E., ENVIRON. PROF., 1989, Vol 11, No 4, pp 324-334. 3. Carnes, S. A., Ibid, pp 422-433.

4. Idem, Ibid, pp 434-446.

5. CHEM. END. NEWS, 1986, Vol 66, No 8, p 15.

6. "Environmental Quality 1985, 16th Annual Report of the Council on Environmental Quality," New York, 1987.

7. Hillsman, E. L., and Coleman, P. R., ENVIRON. PROF. 1989, Vol 11, No 4,, pp 354-366.

8. Kenworthy, W. E., OCCUP. HLTH., 1990, Vol 52, June, pp 24-27.

9. Rogers, G. O., Sorensen, J. H., and Long, J. F., ENVIRON. PROF., 1989, Vol 11, No 4, pp 396-408.

10. Tolbert, V. R., and Breck, J. E., Ibid, pp 367-375.

Creation of a Vector Based on Virus SV40 as an Experimental Model for Studying Gene Expression

957C0109A Moscow VESTNIK ROSSIYSKOY AKADEMII MEDITSINSKIKH NAUK in Russian No 3 Mar 93 (manuscript received 12 Sep 91) pp 6-10

[Article by V.N. Kalinin, M.Ye. Neverova, A.B. Nikoshkov, I.P. Frolova, and T.V. Petrova, Medical Genetic Research Center, Russian Academy of Medical Sciences, Moscow; UDC 575.117.083.2]

[FBIS Abstract] A recombinant SV40 virus was designed with the goal of developing a vector based on SV40 virus that would not require the presence of a helper virus. The C-terminal portion of the gene of the virus' main structural protein [VP-1] was replaced by a synthetic oligonucleotide coding the short physiologically active polypeptide bradykinin [brd]. The plasmid pSE, which is a pBR325 vector into whose *Bam*HI site a neutral DNA fragment bounded by *Bg*lII sites had been inserted, served as the source of the SV40 DNA. A plasmid based on the vector pLB441 served as the source of synthetic bradykinin gene. The *Eco*RI-*Bam*HI fragment of the said vector was replaced by a synthetic bradykinin "gene" flanked on its 5'- and 3-terminals by *Eco*RI and Bam_{HI} sites. After a three-step process, a pSE(brd) plasmid was obtained that carried the entire genome of SV40 virus with an inserted bradykinin "genome." The biological activity of the recombinant virus, which was designated Sv/brd, was studied in a culture of African green monkey kidney cells [CV-1] permissive for SV40. An immunofluorescence method was used to detect T-antigen and study the new recombinant virus' cytopathic effect. Wild SV40 virus and the DNA of virus cut from the plasmid pSE were used as controls. Morphofunctional study of the CV-1 cells that had been infected with SV40 virus and plasmids created on its basis established significant pathological changes (including swelling and increases in the size of their nuclei and the appearance of cytoplasm vacuolization that is specific for the virus) beginning on day 2 after transfection. The observed morphological pattern of degeneration of the CV-1 cells was typical for SV40 virus when it infects permissive cells. The recombinant DNA with the inserted bradykinin "genome" had a lytic effect on the CV-1 cell analogous to that of the virus SV40; however, the recombinant's cytopathic effect appeared later (on days 3-4 versus on day 2 in the case of SV40 virus) and developed at a slower pace. Most CV-1 cells infected with the wild virus died in 6 days, whereas those transformed by the recombinant SV40(brd) died after days 8-9. A study of the synthesis of virus-specific T-antigen in the transformed cells' nuclei established that 78.7 +/- 2.8 percent of the cells infected with SV40 virus synthesized T-antigen, whereas upon transfection with SV40 and SV40(brd) DNA, 65 +/- 2.2 and 45.6 +/- 1.6 percent of cells synthesized T-antigen. The studies confirmed that replacing the C-terminal region of the VP-1 gene by a bradykinin gene sequence does not result in impairment of the basic functions of the BP-1 protein. The newly constructed vector SV40(brd) proved to be stable and suitable as a base for forming biological active virus particles even though it is somewhat less active than the wild type of SV40 virus. Further studies are planned to vary the bradykinin polypeptide's biological activity both as part of a hybrid protein and after it has been split off by cyanogen bromide. Figures 4; references 24: 9 Russian, 15 Western.

Functioning of C31 Phage-Based Integrative Vectors in Strain Streptomyces bambergiensis 712

957A0025A Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol 39 No 6 Jun 94 (manuscript received 21 Dec 93) pp 3-7

[Article by L. I. Soldatova, I. A. Sladkova and A. V. Orekhov, Institute of Genetics and Selection of Industrial Microorganisms, Moscow; UDC 579.25:576.852.1]

[FBIS Abstract] The introduction of autonomously replicating plasmids into Streptomyces strains in some cases results in a reduction of the capacity for synthesizing antibiotics. In studying this problem it is most convenient for cloning purposes to use integrative vectors which exert no negative influence on the level of antibiotic formation. One of the types of integrative vectors is those constructed on the basis of a dead phage of actinomycetes, type C31. Appropriate integrative vectors were constructed. The vectors contain the Escherichia coli plasmid ColEl replicon, the thiostrepton resistance gene used for selection in Streptomyces and a fragment of the C31 actinophage genome with integrative functions. The pS133 and pS135 vector DNAs transformed Streptomyces bambergiensis 712, a strain producing the phosphoglycolipid antibiotic moenomycin. Two types of transformants were detected. The first type was not affected with respect to ability to produce

moenomycin and the vector pS135 DNA was shown to integrate into the S. bambergiensis 712 genome by the site- specific pattern within the C31 phage DNA fragment. The second type of transformants lost the ability to produce moenomycin. The southern analysis and cloning of the inserted DNA indicated that in this case the vector pS135 and pS133 DNAs also integrated specifically into the genome but the integration did not take place within the phage DNA fragment. It is postulated that this process occurs by means of homologous recombination. Figures 3; references 11: 5 Russian, 6 Western.

Efficacy of New Quinolones in Experimental Aerogenic Plague Infection in Albino Mice

957A0025B Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol 39 No 6 Jun 94 (manuscript received 10 Dec 93) pp 13-14

[Article by A. I. Shcherbanyuk, N. V. Lozovoy, I. V. Kasatkina and V. V. Pasyukov, Antiplague Scientific Research Institute; UDC 547.831.9:615.33:616.99]

[FBIS Abstract] The results of study of the efficacy of new third-generation quinolones are given in comparison with nalidixic acid in experimentally induced plague in white mice infected aerogenically. The experiment was made using albino mice weighing 20-22 g. The mice were infected by five-minute inhalation of a finely dispersed aerosol. The infecting dose was 50,000-73,000 living microbe cells. For prophylactic purposes drugs were administered each 6 hours and for therapeutic purposes 24 hours after infection. These drugs were administered per os once a day for seven days. The dose computation method is described (500 mg/kg for nalidixic acid and 125 mg/kg for the new quinolones). Nalidixic acid, even in the maximum doses, allowed only 30-50% of the animals to survive. It was found that unlike nalidixic acid the third-generation quinolones, that is, quinolones containing nitrogen (LIB-71 and LIB-80) and quinolones containing fluorine (pefloxacin and ciprofloxacin), were highly efficacious in the prophylaxis and treatment of experimental plague in albino mice infected by inhalation of plague microbes. As indicated by ED_{50}, the efficacy of pefloxacin was 25-30 times higher than that of nalidixic acid and 60-90 times higher than that of ciprofloxacin. The quinolones containing fluorine were more active than those containing nitrogen. References: 4 Russian.

Comparative Evaluation of Fluoroquinolone Efficacy in Experimental Anthrax

957A0025C Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol 39 No 6 Jun 94 (manuscript received 22 Nov 93) pp 15-19

[Article by S. I. Dyakov, V. V. Katsalukha, I. K. Lebedeva, A. V. Lukashina and V. A. Rayskaya, Military Medicine Scientific Research Institute, St. Petersburg; UDC 547.831.9:616.91]

[FBIS Abstract] Comparative antibacterial activity and protective efficacy of ciprofloxacin, pefloxacin and lomefloxacin were estimated in an anthrax model. The minimum inhibiting concentrations of the three drugs determined by the serial dilutions method for three vaccinal strains of Bacillus anthracis were 0.5 to 1.0 μg/ml. The protective efficacy of the chemotherapeutics in experimental anthrax induced by the spores of the vaccinal strain 71/12 Tsenkovskiy was evaluated in mathematically formulated four-factor experiments. This efficacy was dependent on the infective dose and chemotherapy term and amounted in the protective use of the drugs in daily doses equivalent to those for humans to 80-100% of animals infected with 10 LD_{50} of the biological agent, to 50-80% protection with the use of 100 LD_{50}, to 40-70% protection with the use of 1000 LD_{50} and to 50-90% protection in the therapeutic use of fluoroquinolones. This indicates that the fluoroquinolones were chemotherapeutically highly active in the treatment of experimental anthrax. The well-expressed therapeutic efficacy of the fluoroquinolones and the high percentage of animal protection after their urgent prophylactic administration in a single dose constitute obvious advantages. The total levels of the protective efficacy of the three fluoroquinolones with respect to anthrax were virtually the same. Figures 4; references: 3 Russian.

Ecological Problems Technology for Deep Biological Purification of Sewage

957A0025D Moscow ANTIBIOTIKI I KHIMIOTERAPIYA in Russian Vol 39 No 6 Jun 94 (manuscript received 18 Nov 93) pp 20-22

[Article by N. A. Terentyeva, V. A. Kazaryan, S. N. Chekalova and Z. L. Fayngold, State Antibiotics Scientific Center; Communal Water Supply and Water Purification Scientific Research Institute; UDC 574:621.3.035.82]

[FBIS Abstract] A technological process is described for the deep biological treatment of communal and industrial sewage, and especially the wastes of the pharmaceutical industry and pooled sewage. The deep biological treatment of sewage to the maximum admissible concentrations adopted for water in aquaculture is achieved by the use of deep and immobilized microorganisms in a multistage process under anaerobic and aerobic conditions and the use of chemically active and inert materials as carriers of microorganisms inducing certain biological processes. The material carrier for the microorganisms used was synthetic and natural chemically active and inert materials including modified natural sorbents. These materials and the methods used are described. The first stage involves anaerobic processing using fixed microorganisms; there is a first aerobic stage using a complex of suspended and fixed microorganisms and a second aerobic stage in which only fixed microorganisms are used. The required degree of purification can be attained as a function of the operating parameters of

each stage and the combination of materials used for fixation of the microorganisms. Viability of a test object (Daphnia magna) was ascertained for the waste water in the different stages and compared with data for other treatment facilities. The treated water was tested for ecological purity and its purity index indicated that toxicity was reduced by an order of magnitude, that it is essentially on a par with natural water, is suitable for agricultural purposes and is not harmful for fish life. The new system can be readily incorporated into existing purification facilities. However, the cost of the new technology is approximately 50% greater than traditional total biological purification, but the cost would be offset in several ways.

Portable Devices for Combination Magnetic and Laser Therapy

957A0027A St. Petersburg OPTICHESKIY ZHURNAL in Russian No 6 Jun 94 (manuscript received 28 Dec 93) pp 46-49

[Article by A.B. Ioannisian, candidate of technical sciences, V.N. Simakov, and V.A. Folts; UDC 621.373.826:615.847.8]

[FBIS Abstract] The combined use of low-intensity laser radiation and a local magnetic field for therapeutic purposes is among the most progressive directions in modern medicine. As part of Russia's peacetime conversion program, the Optika State Scientific Production Association has developed and is now producing several types of devices intended for treating a broad range of diseases by combining low-intensity laser radiation with a local magnetic field. The devices each have a different radiating power and unique working part and electronic unit. The working part of the first three devices, designated the AMO, Izel, and Izel-M, is designed in the form of a phonendoscope head, which means that they can be used to listen for auscultative symptoms in treating heart and respiratory organ diseases. The amplitude-frequency characteristics of their acoustic channels conform to those of standard modern phonendoscopes, which means that physicians using them need no special training to diagnose diseases based on auscultative symptoms. A semiconductor laser serves as the central radiator in the Izel and Izel-M, and a light-emitting diode [LED] functions as the central radiator in the AMO. Because the AMO, Izel, and Izel-M irradiate an area of 10 cm^2, they may be used to treat heart and respiratory organ diseases. The Izel-G and Izel-P are intended for intracavitary therapy in the treatment of gynecological and proctological diseases, and each irradiates an area of 2 cm^2. The AMO, Izel, and Izel-M each have a magnetic induction of 40 mT, and the Izel and Izel-M have radiating powers of 3.0 and 20 mW, respectively. The Izel-P and Izel-G have each have a radiating power of 40. All five devices operate on a 220 V/50 Hz circuit. The Izel, Izel-P, and Izel-G have a power requirement of 5 VA, the AMO requires 7 VA, and the Izel-M requires 11 VA. The lasers of all four Izel units have a radiation wavelength of 0.85 μm, and the LEDs of all five devices have a wavelength of 0.95 μm. The electronic units of each of the five devices weighs 0.5 kg, and their working parts each weigh 0.2-0.25 kg. Figures 3, tables 1; references 3 (Russian).

Portable Device for Intracavitary Laser Therapy

957A0027B St. Petersburg OPTICHESKIY ZHURNAL in Russian No 6 Jun 94 (manuscript received 28 Dec 93) pp 49-50

[Article by A.B. Ioannisian, candidate of technical sciences, V.N. Simakov, and N.A. Shipilova; UDC 621.373.826:616-089]

[FBIS Abstract] The Optika State Scientific Production Association has developed a portable device for intracavitary laser therapy. The new device, which is called the Izel-G, may be used in clinical and outpatient settings to treat inflammatory processes of the uterus and uterine appendages and to eliminate painful syndromes. The Izel-G may also be used for the external treatment of various organs and skin by both contact and contactless methods. One unique feature of the Izel-G is the fact that its radiating elements (laser and light-emitting diodes [LEDs]) are located at the end of its working part in direct proximity to the organ/tissue receiving treatment, which reduces radiation loss and scattering. The Izel-G consists of a radiator and an electronic unit. It has a tube that protects the radiator against contamination and mechanical damage during intracavitary therapy. The tube is made of quartz glass possessing high transparency in the near-infrared region of the spectrum, good mechanical strength, and thermal and chemical stability. The tube is removable so that it can be sterilized and disinfected. The Izel-G provides a radiation flux of at least 16 mm. At temperatures of 10 to 35°C, the Izel-G's infrared-semiconductor laser radiates at a wavelength of 0.85 +/- 0.03 μm and its infrared LEDs radiate at a wavelength of 0.95 +/- 0.05 μm. Its laser and LEDs have radiating powers of 3.0 and 40 mW, respectively. The Izel-G requires a 220 V/50 Hz circuit to operate and 5 VA of power, its electronic unit weighs 0.50 kg and measures 92 x 62 x 87 mm, its tub measures 19 mm in diameter and 180 mm in length, and its radiator weighs 0.25 kg and measures 300 x 40 x 40 mm. The Izel-G is easy to use in hospitals, polyclinics, and private practices and received Russian Federation Ministry of Health approval on 11 April 1994. Figure 1; reference 1 (Russian).

Effect of the Cholesterol Content of Liposomes on the Interaction With Serum Blood Proteins

957A0030A Moscow BIOKHIMIYA in Russian Vol 59 No 5 May 94 (manuscript received 02 Nov 93) pp 712-719

[Article by T.S. Zakharova, A.S. Ivanov, A.P. Echkalov, A.T. Berezov, E.M. Khalilov, and A.I. Archakov, Physicochemical Medicine Research Institute, Russian Ministry of Health (first, third, and fifth authors) and Biomedical Chemistry Research Institute, Russian Academy of Medical Sciences, Moscow (second, fourth, and sixth authors)]

[FBIS Abstract]The use of low density lipoproteins (LDLP) of blood plasma as a natural "vector" for directed transport of medicines specifically to tumor cell targets is a promising direction of modern medicine. Existing methods for addition of liposomes to blood plasma LDLP, however—direct covalent cross- linking or conjugation by means of antibodies—lead to modification of the protein, and this reduces the efficacy of the work of the cell receptors. The purpose of this study was to make a liposomal preparation selectively interacting with LDLP.

Blood serum from healthy donors was used: cholesterol 150-190 mg, triglycerides 120-170 mg-percent, and high density lipoproteins, 36-60 mg-percent. Rabbits were used for *in vivo* experiments.

The reaction of blood serum lipoproteins with cholesterol- containing lipoproteins was studied by means of the method of electrophoresis in polyacrylamide gel. The maximal interaction was achieved in the case of the maximally high content of cholesterol in the liposomes (molar ratio of cholesterol: phospholipid of 1.6). In this case, calculation showed that up to 90 percent of the LDLP is bound to the liposomes. At the same time, the position and intensity of color of the LDLP bands was practically unchanged; this indicates the absence of interaction of liposomes with this class of lipoproteins.

The fate of liposomes in contact with blood serum can be quite different. As the result of the interaction with lipoproteins, liposomes can be exchanged with their separate components. Formation of liposome complexes and lipoproteins may also take place by means of aggregation and/or amalgamation. To study this process, lipoproteins were subjected to precipitation and ultracentrifugation with subsequent biochemical analysis of the lipid components. Almost all the cholesterol and phospholipids of the liposomes were observed in the combined LDLP and the high- density lipoproteins (HDLP); this confirms the selectivity of the reaction of liposomes with LDLP. Only 9 percent of the lipids introduced into the liposome preparation are observed in the HDLP fraction; this indicates the negligible mass transfer of phospholipids from the liposomes to HDLP. In an analogous experiment of the incubation of serum with phosphatidylcholine liposomes not containing cholesterol, the phospholipid introduced with the liposomes is observed both in the LDLP and HDLP. This indicates the absence of the selective interaction of liposomes without cholesterol with serum lipoproteins. These findings were confirmed in analogous *in vivo* experiments with rabbits. It is believed that the apolipoprotein B contained in LDLP plays an important role in the effect observed, and that its affinity for liposomes apparently depends on the level of cholesterol in the latter.

Previously the presence of cholesterol in liposome membranes was considered to be a stabilizing factor in the contact of liposomes with blood serum. At the same time, the introduction of high concentrations of cholesterol into liposomes conveys a new property on them—by addition to blood serum they selectively interact with low density lipoproteins both *in vitro* and *in vivo*. It is hoped that there is the possibility of using these natural carriers for directed transport of liposomal hydrophobic biologically active substances into cells. The question of receptor binding of such complexes with cells under physiological conditions requires further research.

Figures: 5; References: Russian 4, Western 18.

Effect of High Pressure on Induced Lipid Peroxidation Processes in Liposomal Membranes

957A0030B Moscow BIOKHIMIYA in Russian Vol 59 No 5 May 94 (manuscript received 14 Dec 93) pp 720-725

[Article by A.V. Vjovin, A. Yu. Tyurin-Kuzmin, D.B. Vandyshev, Department of Underwater Physiology, Oceanology Institute imeni N.I. Shirshov, Russian Academy of Sciences]

[FBIS Abstract] High Pressure (3-5 MPa) produces an increase in the content of lipid peroxidation products and a reduction in the activity of antioxidant enzymes in the blood of animals and humans. The similarity of the symptoms of acute oxygen poisoning and epileptic diseases to high-pressure nerve syndrome indicated the possible participation of lipid peroxidation in the genesis of high-pressure nerve syndrome.

At a hydrostatic pressure of 14 MPa after 10 minutes of reaction in a suspension of liposomes, malonic dialdehyde is formed in an amount by a factor of approximately 1.6 in comparison to the control suspension. Later the amount of malonic dialdehyde formed in the experiment and the control events out and becomes equal to 1.

The helium pressure leads to an increase in the level of malonic dialdehyde during the whole time of recording the lipid peroxidation kinetics. The rate of the reaction increased by approximately one magnitude at all stages of development of the reaction.

The effect of malonic dialdehyde occurs at concentrations of Fe^{2+} taken along both sides of the trigger concentration (μMol); however, it is more evident at 2.5

than at 0.36 μMol. The accumulation of malonic dialdehyde under conditions of pure oxygen under normal pressure (pO^2).

The increase in the formation of malonic dialdehyde in the experiment in contrast to the control at the initial stages of the process can be explained by the increase in the rate of lipid peroxidation under pressure. With the exhaustion of the reaction substrate and conversion to a plateau, the rate of formation of malonic dialdehyde in the experiment and the control become identically small, and the quantity formed in the experiment and the control is identical.

Experiments were conducted in a chamber in which the pressure was produced by compressed helium, which made it possible to observe the initial steps of the reaction and not be limited by the initial supply of oxygen. A pre-incubation period of 5 minutes was used.

One reason for the observed effect of an increase in the rate of lipid peroxidation that was considered was that the pressure shifts the "trigger" zone of the Fe^{2+} concentration. However, the determination of the "trigger" zone of the iron concentration under the given conditions of initiation of lipid peroxidation and the use of Fe^{2+} concentrations on both sides of it did not lead to a qualitative change in the effect.

Another reason considered was the decrease in the solubility of oxygen in water and lipids under conditions of increased hydrostatic pressure, and, as the result, an increase in the partial pressure of O^2 in a water medium, leading to its increased reactability. This reason is rejected also.

The effect of pressure on the rate of the chemical reaction may be related to the change in the activation barrier or a change in its diffusion limitations. Lipid peroxidation is a complicated multistage process, different stages of which cannot be limited activationally and diffusionally. Possibly the observed effect is related to the presence of negative changes in the volume during activation at one of the elementary stages of the process, for which no explanation has yet been found. It is known that under pressure the viscosity of the lipid bilayer changes, which leads to difficulties in diffusion processes and can decrease diffusion-controllable reactions.

The increase in the rate of liquid peroxidation induced by Fe- ascorbate under high pressure is probably due to the increase in polarity of the lipid bilayer under hyperbaric conditions.

Figures: 4; References: Russian 5, Western 9.

New Organo-mineral Sorbent-ameliorants For Detoxication of Soils Polluted by Heavy Metals

957C0055A Moscow DOKLADY ROSSIYSKOY AKADEMII SELSKOKHOZYAYSTVENNYKH NAUK (manuscript received Feb 8 93)No 4 Jul-Aug 94 pp 16-18.

[Article by L. A. Kireycheva and I. V.Glazunova; All-Russian Scientific Research Institute of Water Engineering and Land Reclamation] UDC 631.45:504.53.06:631.416.8

[FBIS Abstract] Raw material components for a new sorbent-ameliorant were selected to ensure high capacitance of cation exchange, simultaneous presence of organic and mineral components, physiological neutrality (pH 6.0-7.5) and reaction after application of the sorbent to the soil. The new sorbent-ameliorant SORBEKS may be used for preliminary detoxification of soil contaminated by mobile forms of heavy metals. Application of the sorbent ensured detoxification of the soil, improvement of it and an increase of soil fert ility. Physical and chemical properties of the new sorbent-ameliorant were described and discussed. The product may be modified according to the type of soils involved, the degree and nature of contamination involved and the aims of detoxification. Recommendations for use of the product were proposed. References 11: 9 Russian; 2 Western.

Selection and Assessment of Criterion of Erosion Resistance of Agrolandscape Based on Computer Technology

957C0055B Moscow DOKLADY ROSSIYSKOY AKADEMII SEL'SKOKHOZYAYSTVENNYKH NAUK (manuscript received Feb 8 93)No 4 Jul-Aug 94 pp 23-24

[Article by Yu.P. Sukhonovskiy, V.N. Brantzov and A.I. Sanzharov; All-Russian Scientific-Research Institute of Agriculture and Protection of Soils from Erosion] UDC 631.459

[FBIS Abstract] An approach to selection of a criterion of erosion resistance of an agrolandscape was devised for an experimental farm located in Medvenskiy rayon, Kursk oblast. The study involved highly alkaline chernozems and typical heavy loamy soils. The area of eroded soils was 47 percent. A methodical approach to determination of the maximum level of intensity of erosion and deflation processes was described and discussed. The significance of this criterion for a given farm was evaluated by use of computer technology. Selection of anti-erosion measures on the basis of this approach to assessing permissible losses of soil guarantees that the agrolandscape will be erosion resistant. Figure 1; references 11: 10 Russian, 1 Western.

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